Zacta

TEST REPORT

Report number : Z101C-16016
Issue date : March 4, 2016

The device, as described herewith, was tested pursuant to applicable test procedure and complies with the requirements of;

FCC Part15 Subpart C
IC RSS-247

The test results are traceable to the international or national standards.

Applicant	:	Seiko Instruments Inc.
Equipment under test (EUT)	:	Wireless LAN module
Model number	:	IFWL-001
FCC ID	:	C4ZAB000005
IC Certification number	:	4445A-AB000005

Date of test	:	January 5, 8, 14, 15, 18, 21, 28, 2016
Test place	:	TÜV SÜD Zacta Ltd. Yonezawa Testing Center 4149-7 Hachimanpara 5-chome Yonezawa-shi Yamagata 992-1128 Japan Phone: +81-238-28-2880 Fax: +81-238-28-2888
Test results	:	Complied

The results in this report are applicable only to the equipment tested.
This report shall not be re-produced except in full without the written approval of TÜV SÜD Zacta Ltd.
This test report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the federal government.

Tested by : Hikaru Shibata
Hikaru Shibata

Authorized by : Hiro Suzuki
Hiroaki Suzuki
Manager of EMC Technical Department

Zacta

Table of contents

Zacta

Zacta

1. Summary of Test

1.1 Purpose of test

It is the original test in order to verify conformance to FCC Part 15 Subpart C and IC RSS-247.

1.2 Standards

CFR47 FCC Part 15 Subpart C
IC RSS-247

1.2.1 Test Methods

ANSI C63.10-2013, KDB 558074 D01 DTS Meas Guidance v03r04

1.2.2 Deviation from standards

None

1.3 List of applied test to the EUT

FCC Section	IC Section	Test items	Condition	Result
15.247(a)(2)	RSS-247 5.2(1)	6dB Bandwidth (Occupied bandwidth)	Conducted	PASS
15.247(b)(3)	RSS-247 5.4(4)	Maximum Peak output power	Conducted	PASS
15.247(d)	RSS-247 5.5	Band Edge Compliance of RF Conducted Emissions	Conducted	PASS
15.247(d) 15.205 15.209	RSS-247 5.5	Spurious Emissions	Conducted Radiated	PASS
15.247(d) 15.205 15.209	RSS-Gen 8.9	Restricted Bands of Operation	Radiated	PASS
15.247(e)	RSS-247 5.2(2)	Transmitter Power Spectral Density	Conducted	PASS
15.207	RSS-Gen 8.8	AC Power Line Conducted Emissions	Conducted	PASS

1.3.1 Test set up

Table-Top

1.4 Modification to the EUT by laboratory

None

2. Equipment Under Test

2.1 General Description of equipment

EUT is the Wireless LAN module.

2.2 EUT information

Applicant	:	Seiko Instruments Inc. 8,Nakase 1-chome, Mihama-ku Chiba-shi 261-8507 Chiba, Japan Phone: +81-43-211-1148
Equipment under test	:	Wireless LAN module
Trade name	:	SII
Model number	:	IFWL-001
Serial number	:	0011E5062AB1 (Radiated) 0011E5062AAA (Conducted)
EUT condition	:	Pre-Production
Power ratings	:	Battery: DC 3.3V
Size	:	(W) 53.1 × (D) 35.4 × (H) 6.41 mm
Environment	:	Indoor and Outdoor use
Thermal limitation	:	-20˚C to 55˚C
RF Specification		
Protocol	:	IEEE802.11b, IEEE802.11g, IEEE802.11n (HT20)
Frequency range	:	2412MHz-2462MHz
Number of RF Channels	:	11 Channels
Modulation type	:	IEEE802.11b: DSSS (DBPSK, DQPSK, CCK) IEEE802.11g / n (HT20): OFDM (BPSK, QPSK, 16QAM, 64QAM)
Data rate	:	IEEE802.11b: 1, 2, 5.5, 11Mbps IEEE802.11g: 6, 9, 12, 18, 24, 36, 48, 54Mbps IEEE802.11n (HT20 LGI): 6.5, 13, 19.5, 26, 39, 52, 58.5, 65Mbps
Channel separation	:	5MHz
Output power	:	15.758mW (IEEE802.11b) 17.159mW (IEEE802.11g) 16.125mW (IEEE802.11n: HT20)
Antenna type	:	Chip antenna
Antenna gain	:	0.4dBi

2.3 Variation of the family model(s)

Not applicable

2.4 Operating channels and frequencies

Channel	Frequency [MHz]
1	2412
2	2417
3	2422
4	2427
5	2432
6	2437
7	2442
8	2447
9	2452
10	2457
11	2462

2.5 Operating mode

The EUT had been tested under operating condition.
There are three channels have been tested as following:

Tested Channel	Frequency [MHz]
Low	2412
Middle	2437
High	2462

The pre-test has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates.

Tested Channel	Modulation Type	Data Rate
Low, Middle, High	IEEE802.11b: DSSS	1Mbps
Low, Middle, High	IEEE802.11g: OFDM	6Mbps
Low, Middle, High	IEEE802.11n (HT20 LGI): OFDM	MCS0 (6.5Mbps)

The field strength of spurious emissions was measured at each position of all three axis X, Y and Z to compare the level, and the maximum noise.
The worst emission was found in Z axis and the worst case recorded.

2.6 Operating flow

[Tx mode]
i) The setting of communication with Putty-062.exe and tftpd32.exe
ii) Test program setup to the artgui.exe
iii) Select a Test mode Operating frequency: Channel Low: 2412MHz, Channel Middle: 2437MHz, Channel High: 2462MHz
iv) Start test mode

[Rx mode]
i) The setting of communication with Putty-062.exe and tftpd32.exe
ii) Test program setup to the artgui.exe
iii) Select a Test mode Operating frequency: Channel Low: 2412MHz, Channel Middle: 2437MHz, Channel High: 2462MHz
iv) Start test mode

Zacta

3. Configuration of equipment

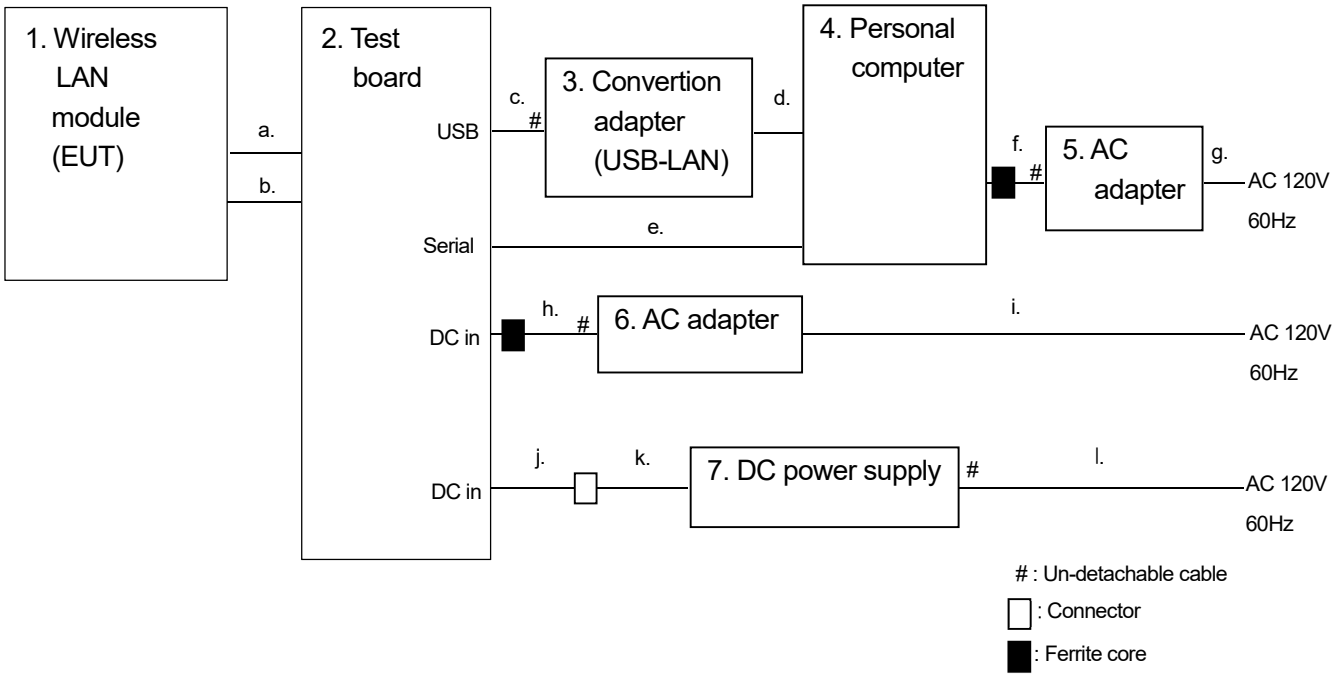
3.1 Equipment(s) used

No.	Equipment	Company	Model No.	Serial No.	FCC ID / DoC	Comment
1	Wireless LAN module	SII	IFWL-001	0011E5062AB1	C4ZAB000005	EUT
2	Test board	SII	N/A	No.2	N/A	Host device
3	Conversion adapter(USB-LAN)	N/A	N/A	N/A	N/A	Accessory
4	Personal computer	FUJITSU	FMVNC4DC3	R7101676	DoC	-
5	AC adapter	FUJITSU	ADP-60ZH A	CP281868-01	N/A	-
6	AC adapter	SII	NU50-20933400-13	N/A	N/A	Accessory
7	DC Power supply	KIKUSUI	PAB32-2	47306490	N/A	-

3.2 Cable(s) used

No.	Cable	Length[m]	Shield	Connector	Comment
a	Flat cable	0.025	NO	Metal	-
b	Signal cable	0.1	NO	Plastic	-
c	USB cable of Conversion adapter	0.1	YES	Metal	-
d	LAN cable	2.0	NO	Plastic	-
e	Serial cable	1.7	YES	Metal	-
f	DC cable of AC adapter for PC	1.9	YES	Metal	-
g	AC power cord of AC adapter for PC	1.7	NO	Plastic	-
h	DC cable of AC adapter for test board	1.8	YES	Metal	-
i	AC power cord of AC adapter for test board	1.7	NO	Plastic	-
j	DC cable of Test board	0.5	NO	Plastic	-
k	DC cable of DC power supply	1.4	NO	Plastic	-
l	AC power code of DC power supply	2.0	NO	Plastic	-

3.3 System configuration



Note1: Numbers assigned to equipment or cables on this diagram correspond to the list in “3.1 Equipment(s) used” and “3.2 Cable(s) used”.
Note2: One ferrite core for DC cable (No.f) is not an accessory of EUT.
Note3: One ferrite core of DC cable (No.h) is accessory of AC adapter (No.6).

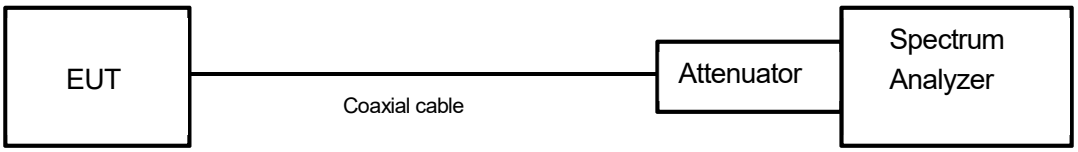
4. 6dB Bandwidth

4.1 Measurement procedure
[FCC 15.247(a)(2), RSS-247 5.2(1), KDB 558074 D01 v03r04, Section 8.2]

The bandwidth at 6dB down from the highest inband spectral density is measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency.

The spectrum analyzer is set to;
a) RBW = 100kHz.
b) VBW ≥ 3 x RBW.
c) Sweep time = auto-couple.
d) Detector = peak.
e) Trace mode = max hold.

- Test configuration



4.2 Limit

The minimum permissible 6dB bandwidth is 500kHz.

4.3 Measurement result

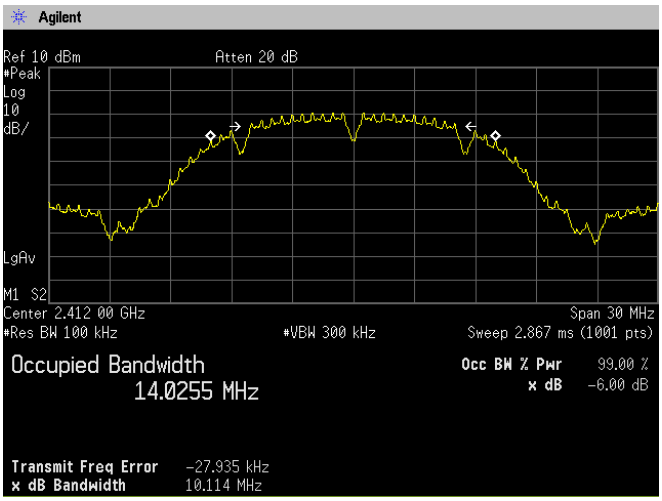
Date : January 8, 2016
Temperature : 21.4 [˚C]
Humidity : 49.2 [%]
Test place : Shielded room No.4

Test engineer : Hikaru Shibata

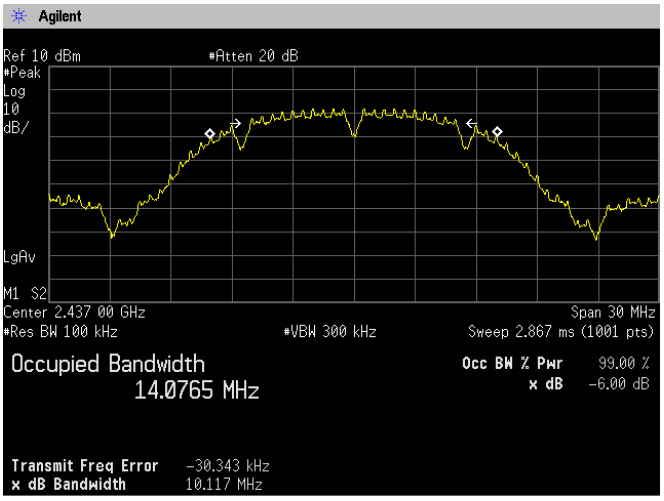
Channel	Frequency [MHz]	6dB bandwidth [MHz]		
		IEEE802.11b	IEEE802.11g	IEEE802.11n (HT20)
Low	2412	10.114	16.359	17.586
Middle	2437	10.117	16.373	17.590
High	2462	10.123	16.361	17.580

4.4 Trace data
[IEEE802.11b]

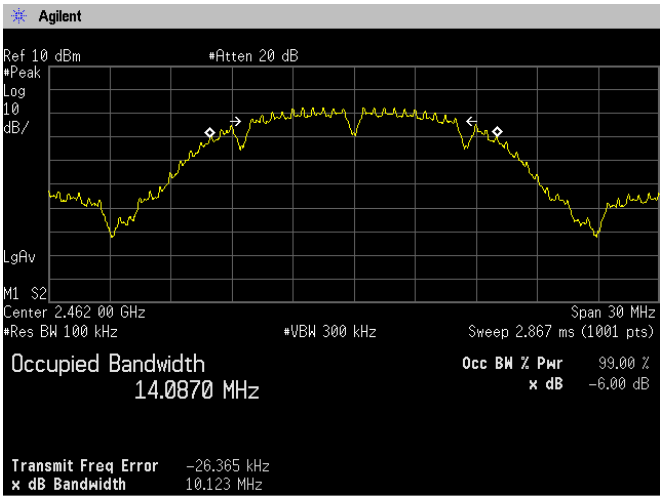
Channel Low



Channel Middle

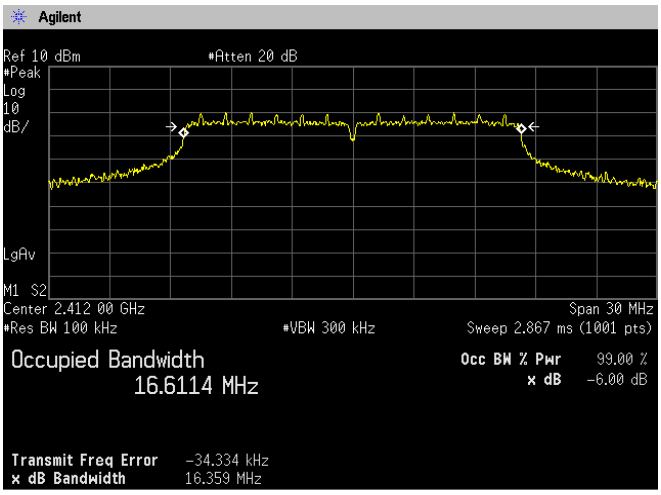


Channel High

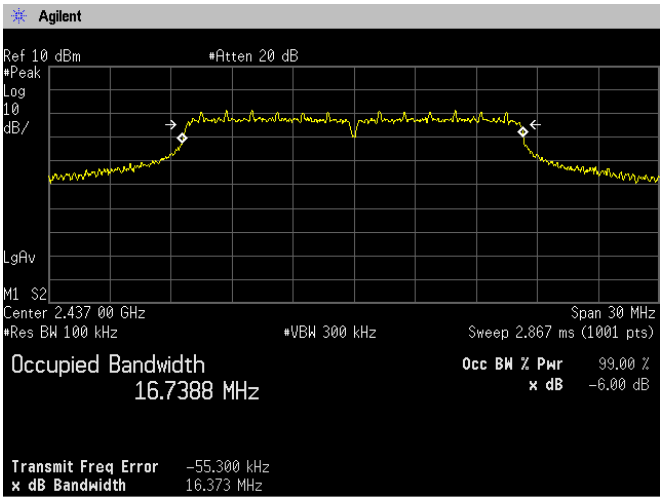


[IEEE802.11g]

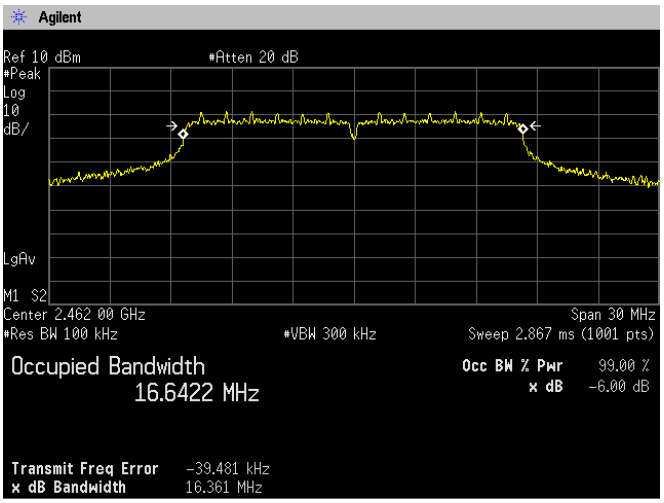
Channel Low



Channel Middle

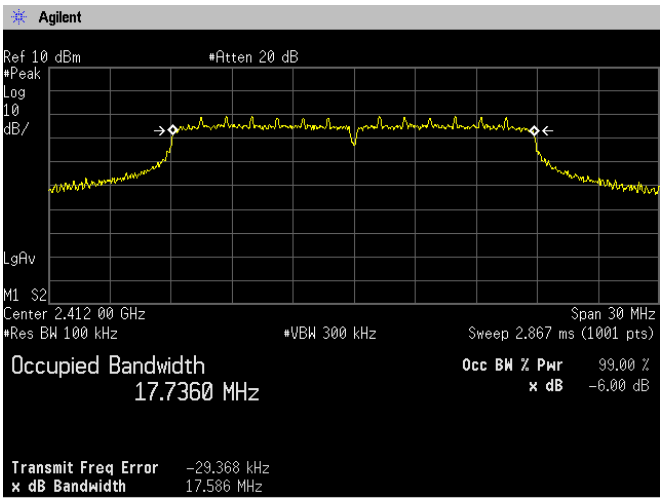


Channel High

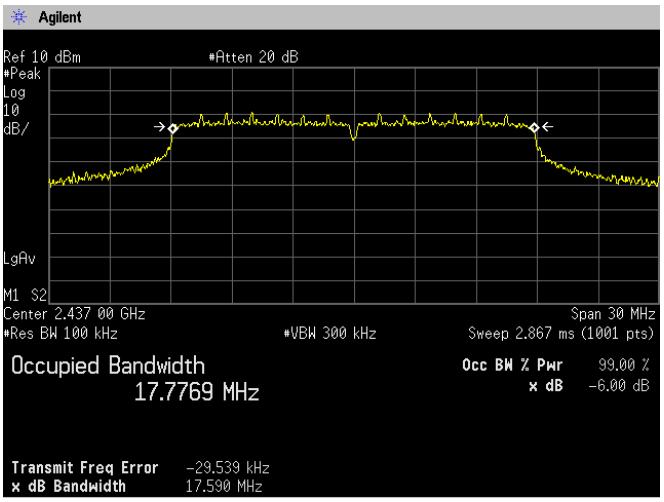


[IEEE802.11n (HT20)]

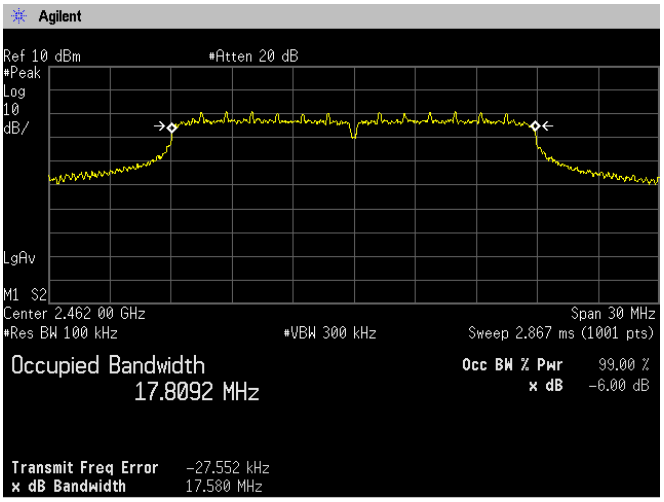
Channel Low



Channel Middle



Channel High



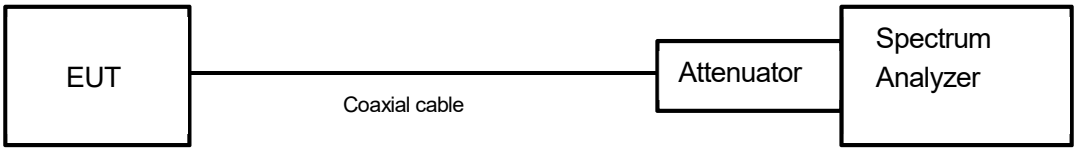
5. Maximum Peak output power

5.1 Measurement procedure
[FCC 15.247(b)(3), RSS-247 5.4(4), KDB 558074 D01 v03r04, Section 9.1.2]

The peak power is measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency.

The spectrum analyzer is set to;
a) RBW = 1-5% of the DTS bandwidth not to exceed 1MHz.
b) VBW ≥ 3 x RBW.
c) Span ≥ 1.5 times the DTS bandwidth.
d) Sweep time = auto-couple.
e) Detector = RMS.
f) Trace mode = Clear/Write, Single, 100 count
g) Points ≥ 2 x Span / RBW

- Test configuration



5.2 Limit

1W (1000mW) or less

5.3 Measurement result

Date	:	January 8, 2016		
Temperature	:	21.4 [˚C]		
Humidity	:	49.2 [%]	Test engineer	:
Test place	:	Shielded room No.4		Hikaru Shibata

[IEEE802.11b]

Battery Full

Channel	Center Frequency (MHz)	Reading (dBm)	Factor (dB)	Level (dBm)	Peak Output Power (mW)	Limit (mW)	Result
Low	2412.00	-0.76	10.48	9.72	9.365	≦1000	PASS
Middle	2437.00	0.67	10.48	11.15	13.017	≦1000	PASS
High	2462.00	1.50	10.48	11.98	15.758	≦1000	PASS

[IEEE802.11g]

Battery Full

Channel	Center Frequency (MHz)	Reading (dBm)	Factor (dB)	Level (dBm)	Peak Output Power (mW)	Limit (mW)	Result
Low	2412.00	0.16	10.48	10.64	11.574	≦1000	PASS
Middle	2437.00	1.72	10.48	12.20	16.577	≦1000	PASS
High	2462.00	1.87	10.48	12.35	17.159	≦1000	PASS

[IEEE802.11n (HT20)]

Battery Full

Channel	Center Frequency (MHz)	Reading (dBm)	Factor (dB)	Level (dBm)	Peak Output Power (mW)	Limit (mW)	Result
Low	2412.00	-0.07	10.48	10.41	10.977	≦1000	PASS
Middle	2437.00	1.60	10.48	12.08	16.125	≦1000	PASS
High	2462.00	1.59	10.48	12.07	16.088	≦1000	PASS

Calculation;

Reading (dBm) + Factor (dB) = Level (dBm)

10logP = Level (dBm)

$P = 10^{(\text{Maximum Peak Output Power} / 10)}$ (mW)

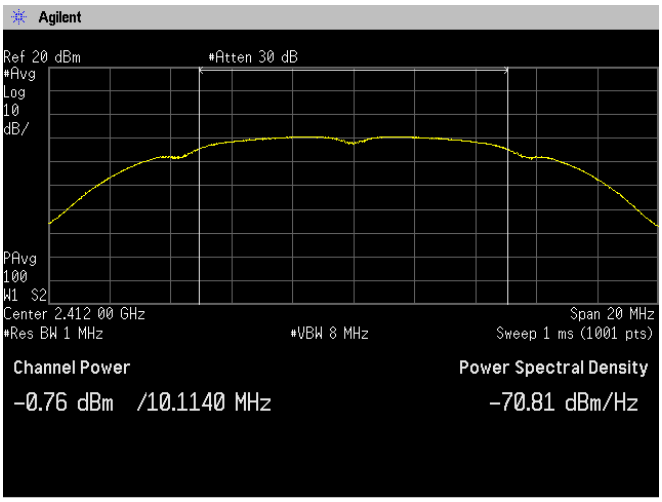
Zacta

5.4 Trace data

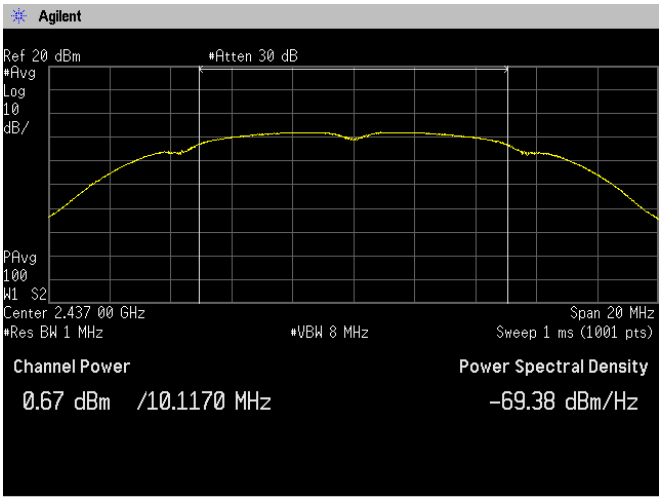
[IEEE802.11b]

[Battery Full]

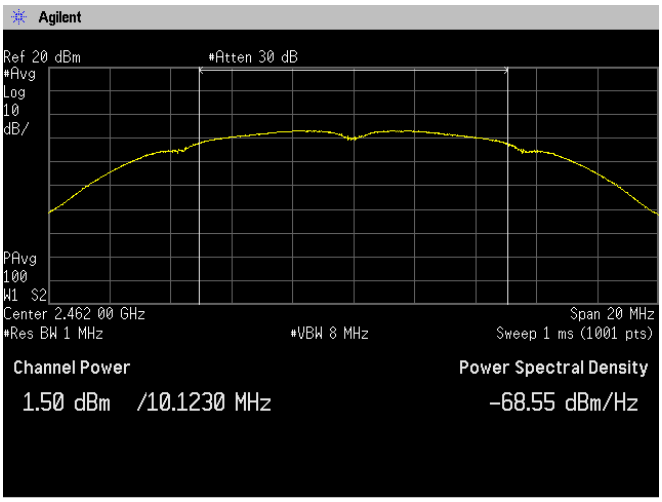
Channel Low



Channel Middle



Channel High

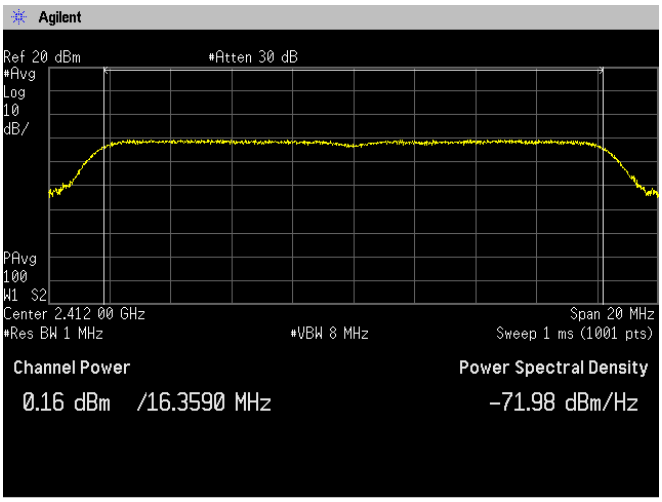


Zacta

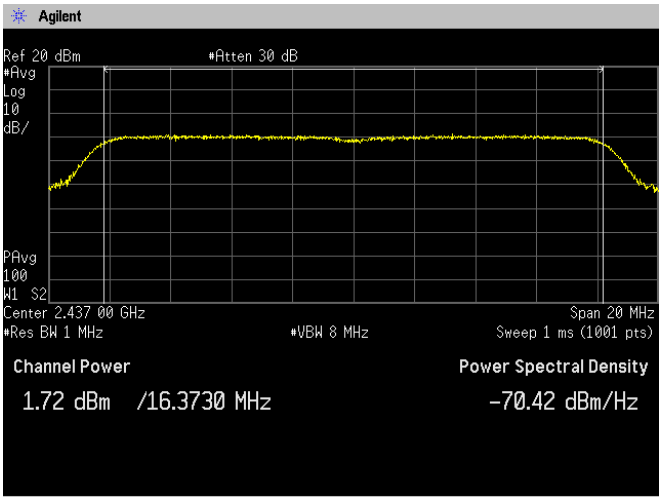
[IEEE802.11g]

[Battery Full]

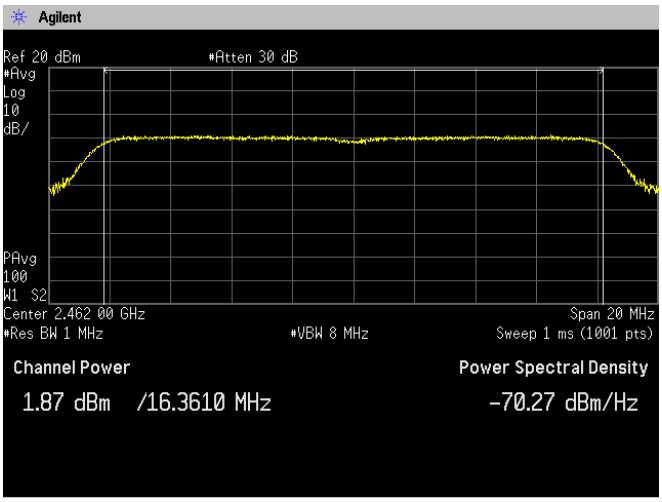
Channel Low



Channel Middle



Channel High

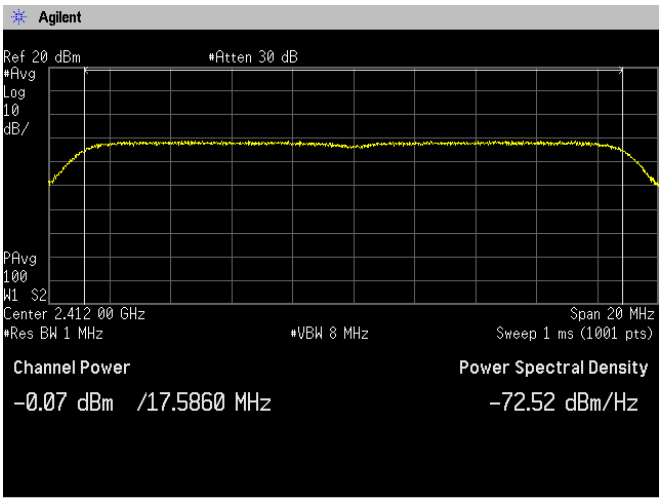


Zacta

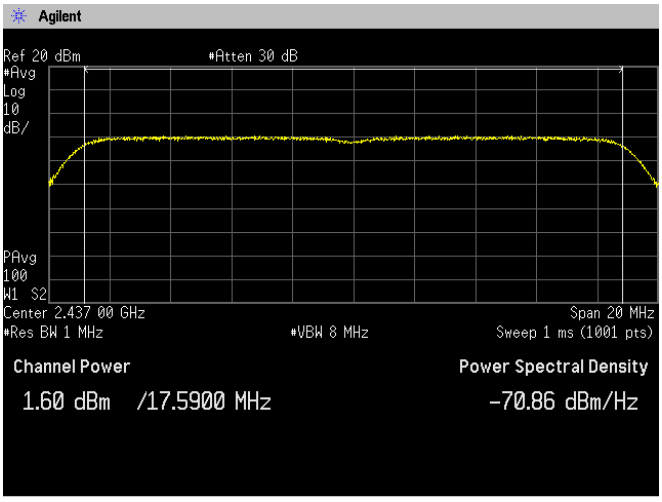
[IEEE802.11n(HT20)]

[Battery Full]

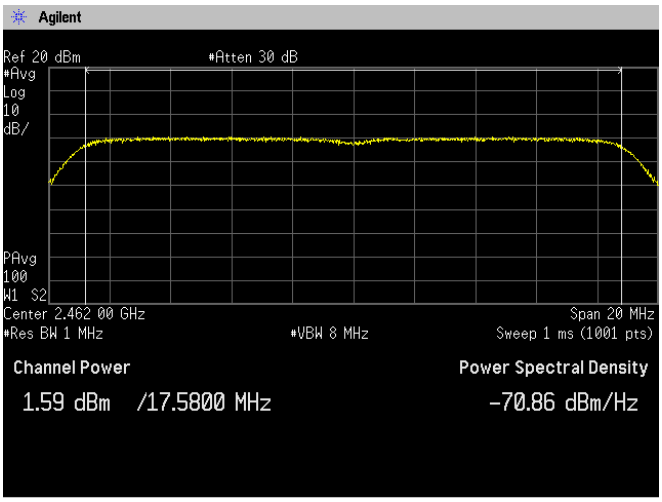
Channel Low



Channel Middle



Channel High



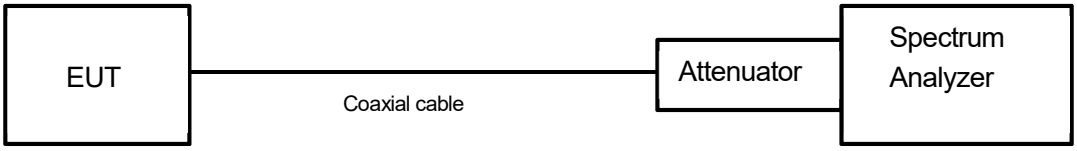
6. Band Edge Compliance of RF Conducted Emissions

6.1 Measurement procedure
[FCC 15.247(d), RSS-247 5.5, KDB 558074 D01 v03r04, Section 11.0]

The Band Edge is measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency.

The spectrum analyzer is set to;
a) Span = Arbitrary setting. (Setting suitable for measurement.)
b) RBW ≥ 1% of the span
c) VBW ≥ RBW
d) Sweep time = auto-couple.
e) Detector = peak.
f) Trace mode = max hold.

- Test configuration



6.2 Limit

In any 100kHz bandwidth outside the frequency band the radio frequency power that is produced by the intentional radiator shall be at least 30dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power.

6.3 Measurement result

Date : January 8, 2016
Temperature : 21.4 [˚C]
Humidity : 49.2 [%]
Test place : Shielded room No.4
Test engineer : Hikaru Shibata

[IEEE802.11b]

Channel	Frequency (MHz)	RF Power Level (dBm)	Band-edge Frequency (MHz)	Band-edge Level (dBm)	Difference Level (dBm)	Limit (dBm)	Result
Low	2412.00	-9.95	2396.96	-48.53	38.58	At least 30dB below from peak of RF	PASS
High	2462.00	-7.80	2484.70	-67.56	59.76	At least 30dB below from peak of RF	PASS

[IEEE802.11g]

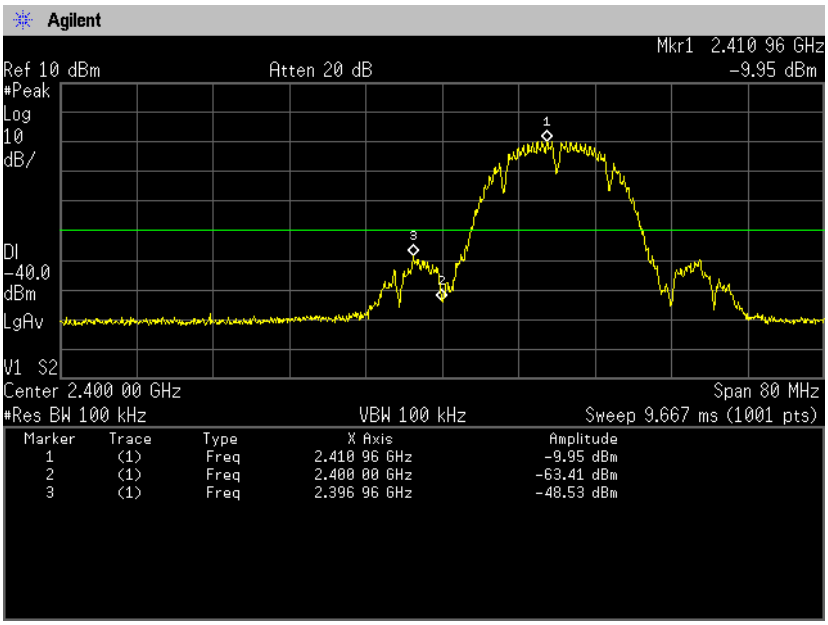
Channel	Frequency (MHz)	RF Power Level (dBm)	Band-edge Frequency (MHz)	Band-edge Level (dBm)	Difference Level (dBm)	Limit (dBm)	Result
Low	2412.00	-7.19	2399.84	-38.01	30.82	At least 30dB below from peak of RF	PASS
High	2462.00	-7.82	2483.58	-49.13	41.31	At least 30dB below from peak of RF	PASS

[IEEE802.11n (HT20)]

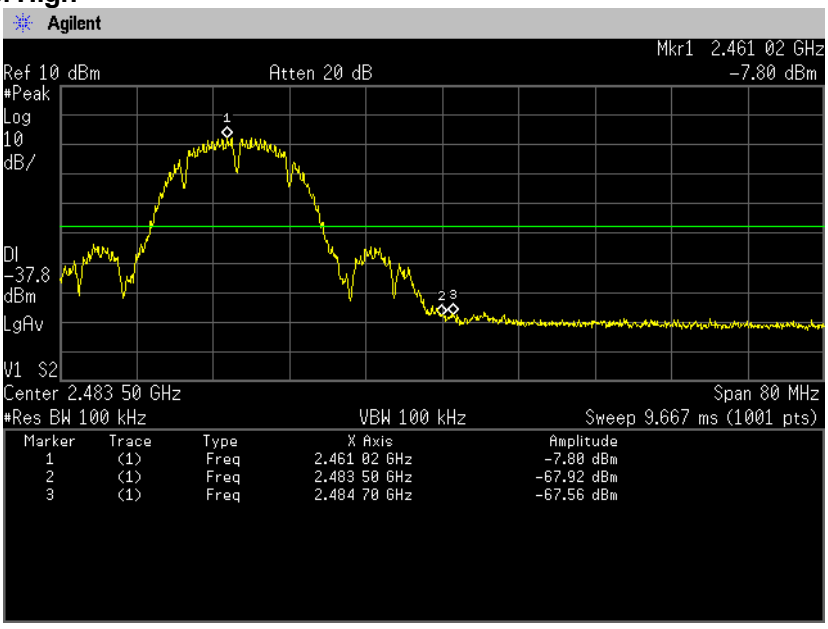
Channel	Frequency (MHz)	RF Power Level (dBm)	Band-edge Frequency (MHz)	Band-edge Level (dBm)	Difference Level (dBm)	Limit (dBm)	Result
Low	2412.00	-7.18	2399.84	-37.77	30.59	At least 30dB below from peak of RF	PASS
High	2462.00	-7.51	2483.58	-46.55	39.04	At least 30dB below from peak of RF	PASS

6.4 Trace data [IEEE802.11b]

Channel Low

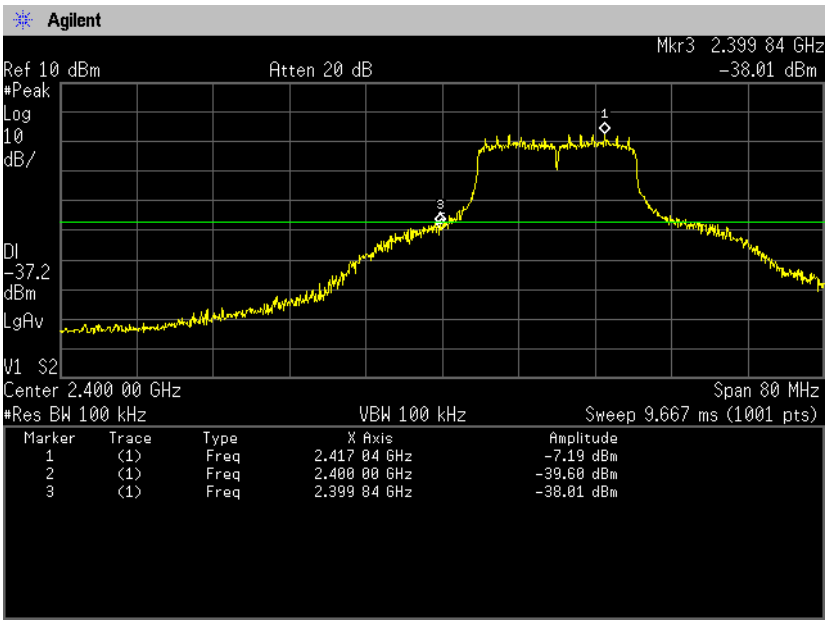


Channel High

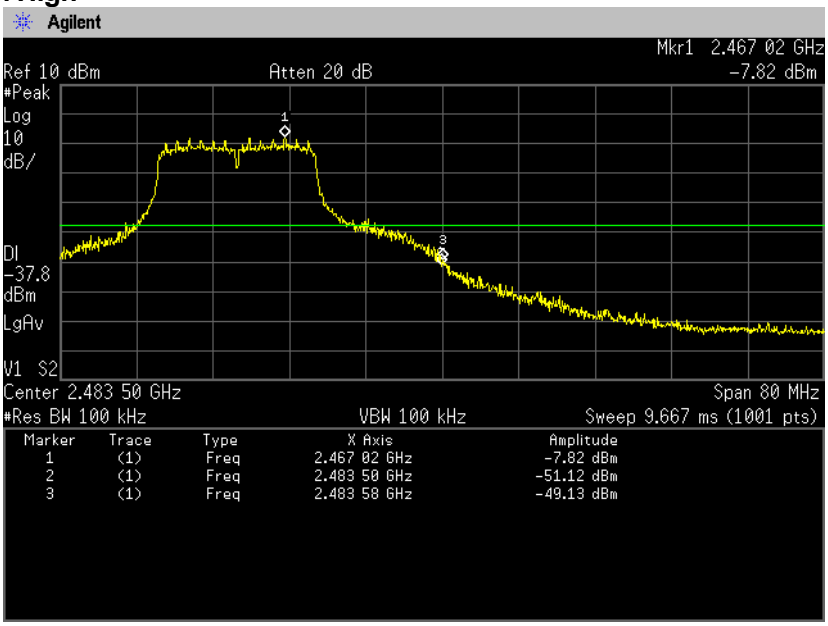


[IEEE802.11g]

Channel Low

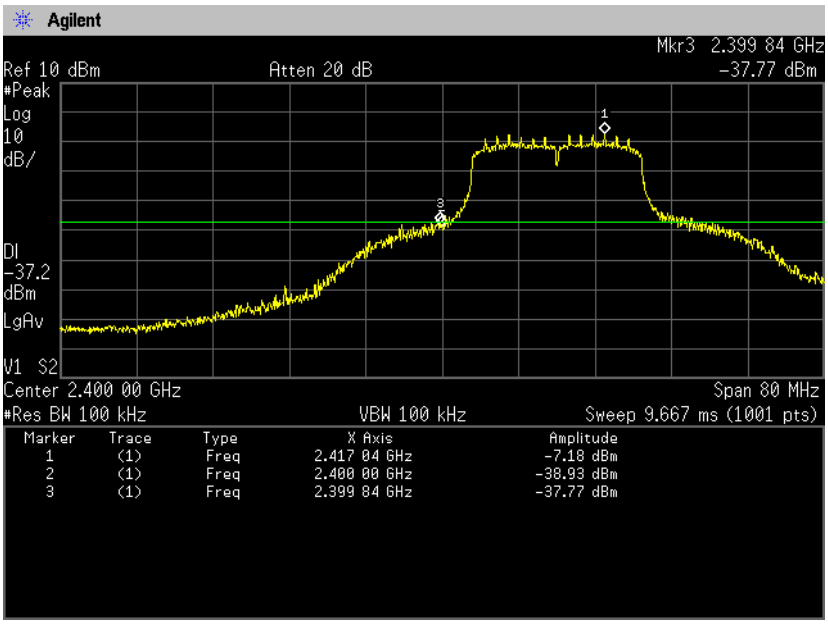


Channel High

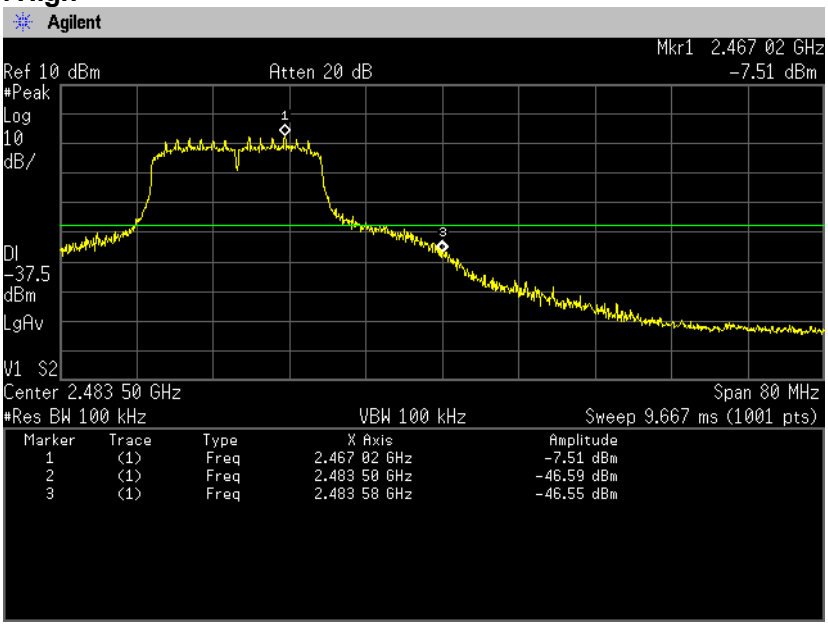


[IEEE802.11n (HT20)]

Channel Low



Channel High



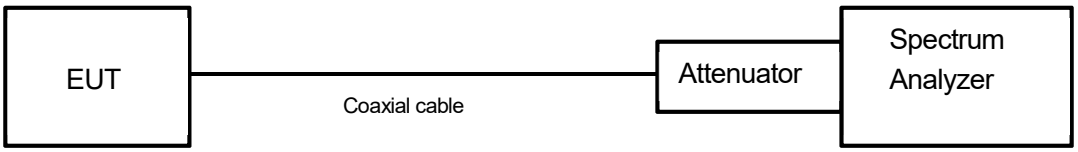
7. Spurious emissions - Conducted -

7.1 Measurement procedure
[FCC 15.247(d), RSS-247 5.5, KDB 558074 D01 v03r04, Section 11.0]

The spurious emissions (Conducted) are measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency.

The spectrum analyzer is set to;
a) Span = wide enough to fully capture the emission being measured.
b) RBW = 100 kHz.
c) VBW ≥ RBW.
d) Sweep time = auto-couple.
e) Detector = peak.
f) Trace mode = max hold.

- Test configuration



7.2 Limit

In any 100kHz bandwidth outside the frequency band the radio frequency power that is produced by the intentional radiator shall be at least 30dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power.

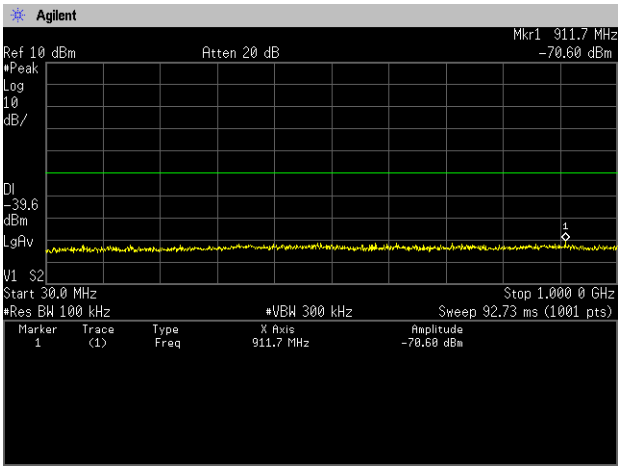
7.3 Measurement result

Date : January 8, 2016
Temperature : 21.4 [˚C]
Humidity : 49.2 [%] Tested by : Hikaru Shibata
Test place : Shielded room No.4

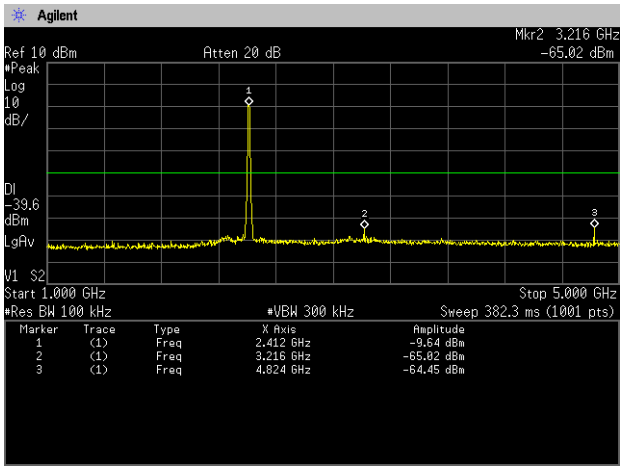
Channel	Frequency [MHz]	Limit [dB]	Results Chart	Result
Low	2412	At least 30dB below from peak of RF	See the trace Data	PASS
Middle	2437	At least 30dB below from peak of RF	See the trace Data	PASS
High	2462	At least 30dB below from peak of RF	See the trace Data	PASS

7.4 Trace data
[IEEE802.11b]
Channel Low

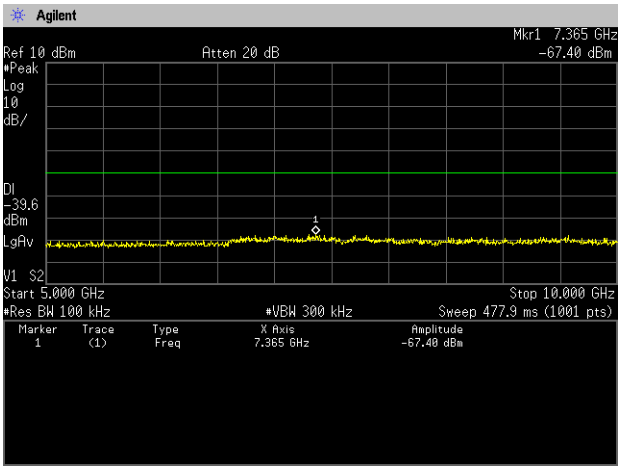
30MHz-1GHz



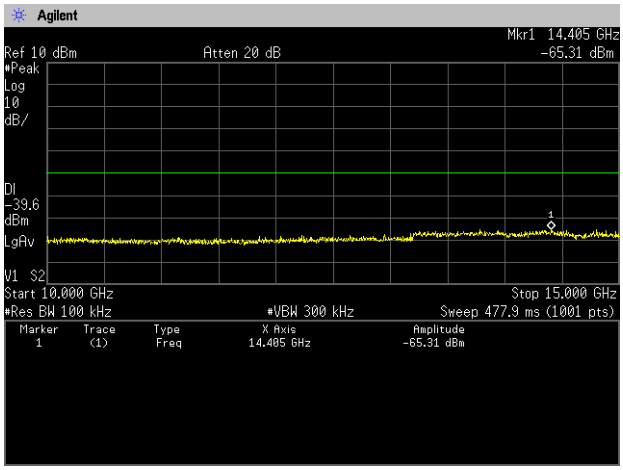
1GHz-5GHz



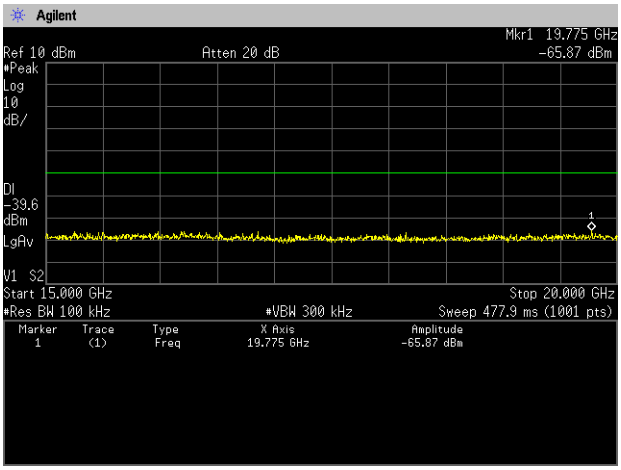
5GHz-10GHz



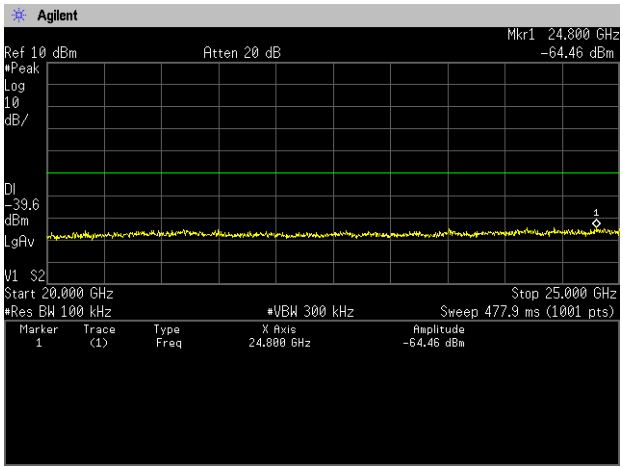
10GHz-15GHz



15GHz-20GHz

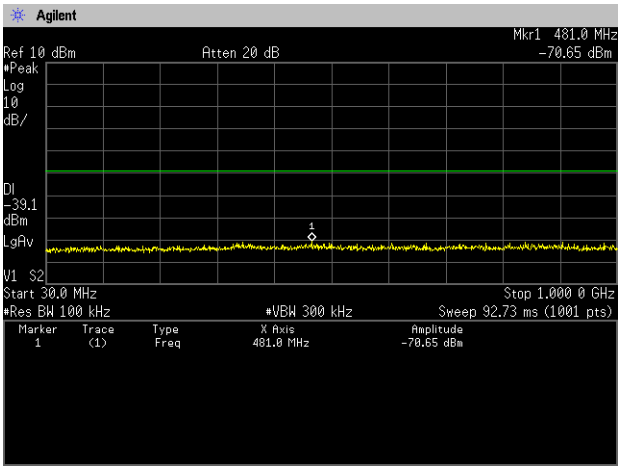


20GHz-25GHz

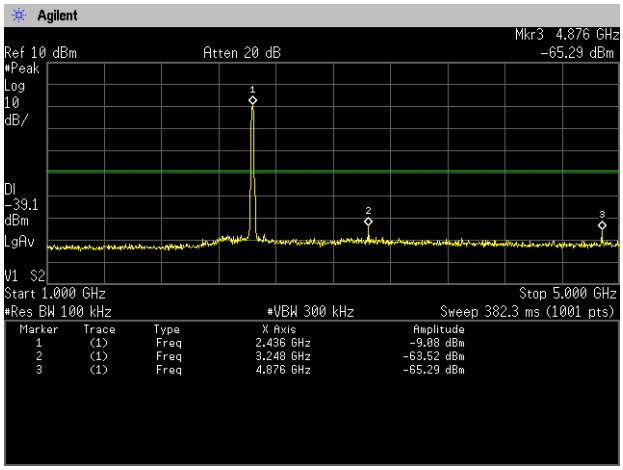


Channel Middle

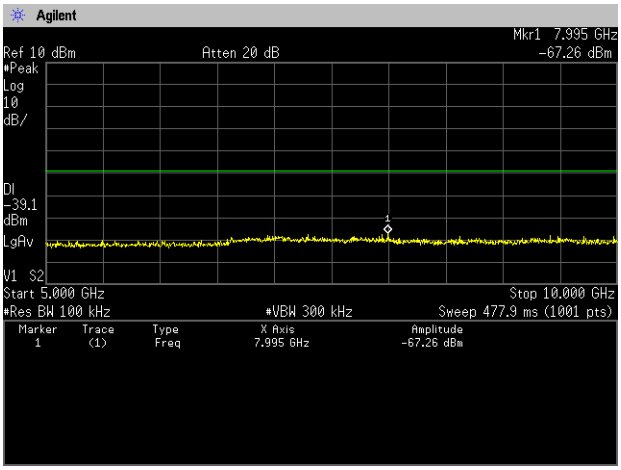
30MHz-1GHz



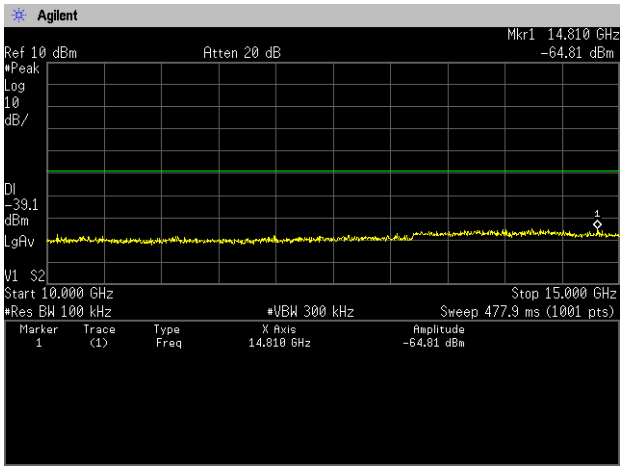
1GHz-5GHz



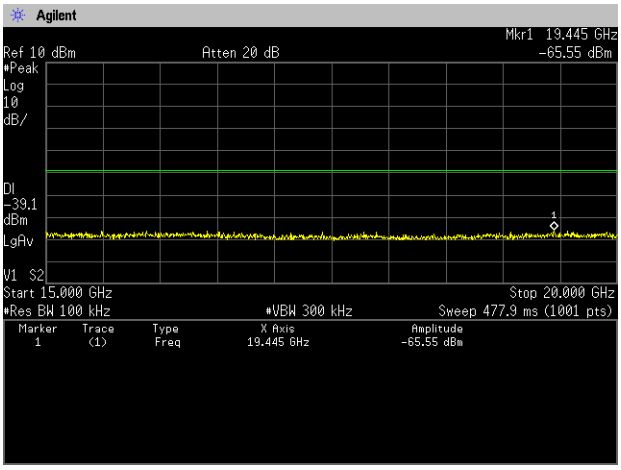
5GHz-10GHz



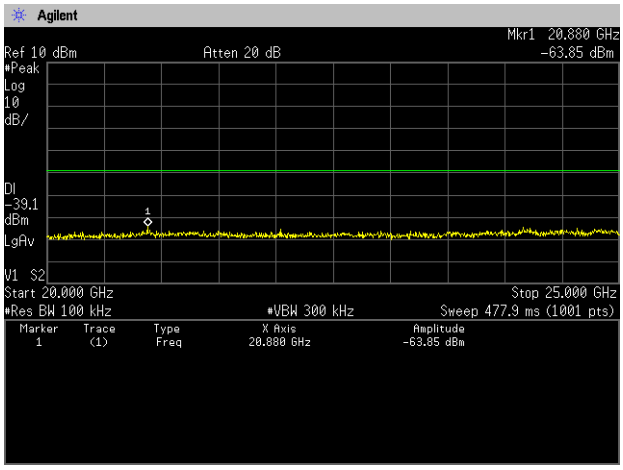
10GHz-15GHz



15GHz-20GHz



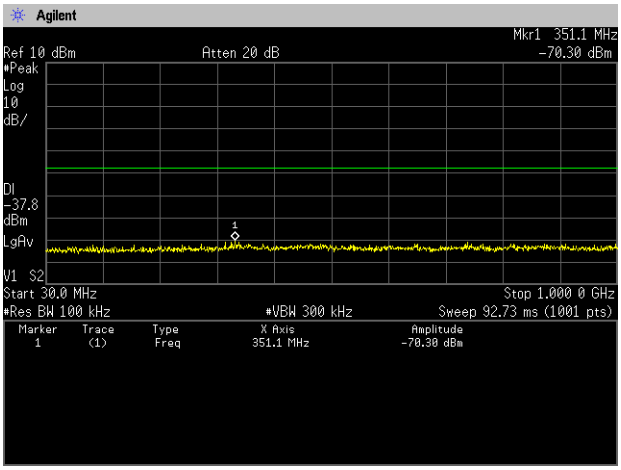
20GHz-25GHz



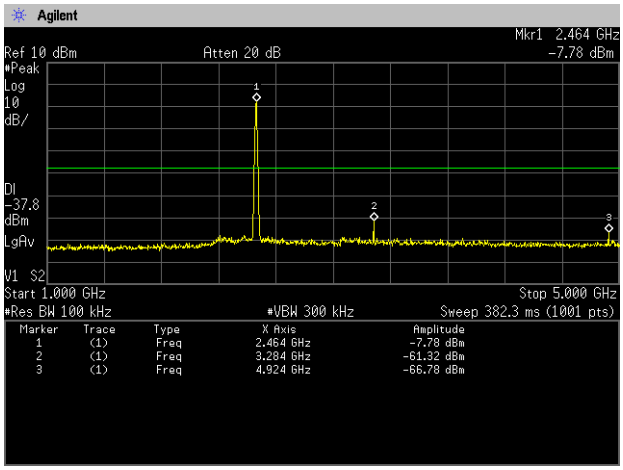
Zacta

Channel High

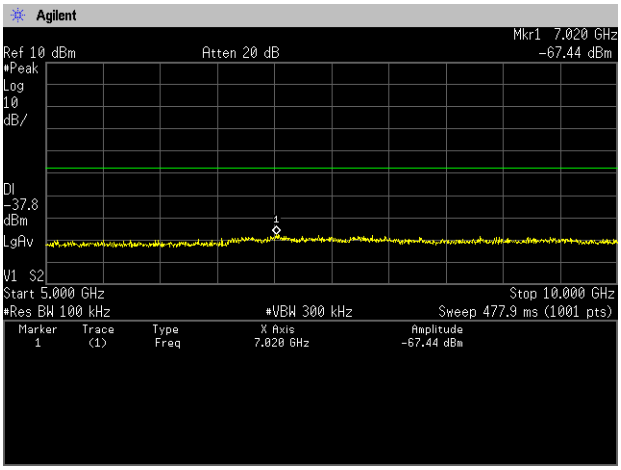
30MHz-1GHz



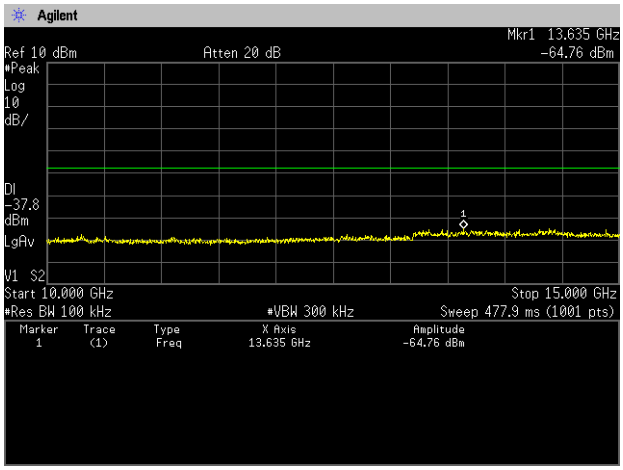
1GHz-5GHz



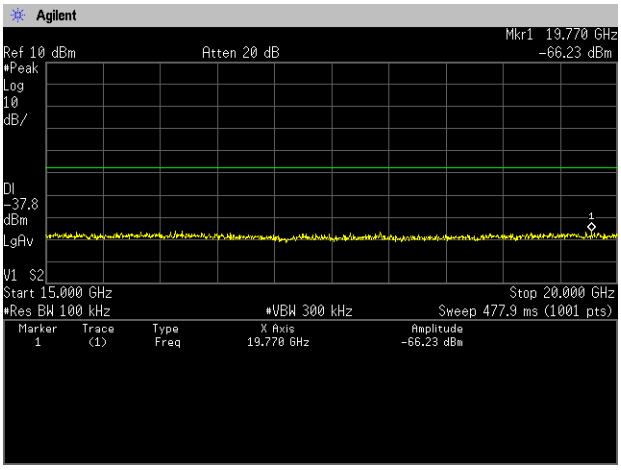
5GHz-10GHz



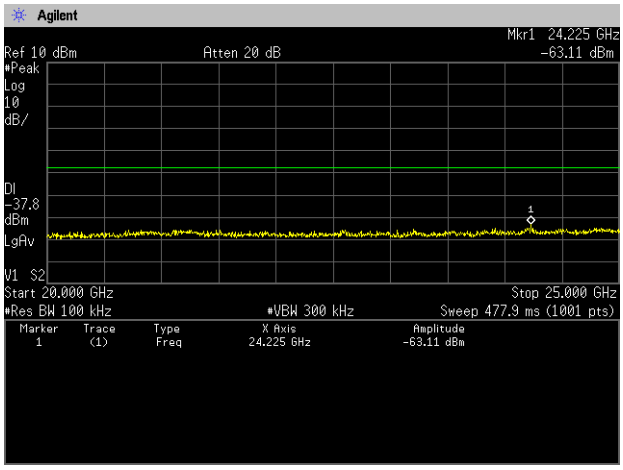
10GHz-15GHz



15GHz-20GHz



20GHz-25GHz

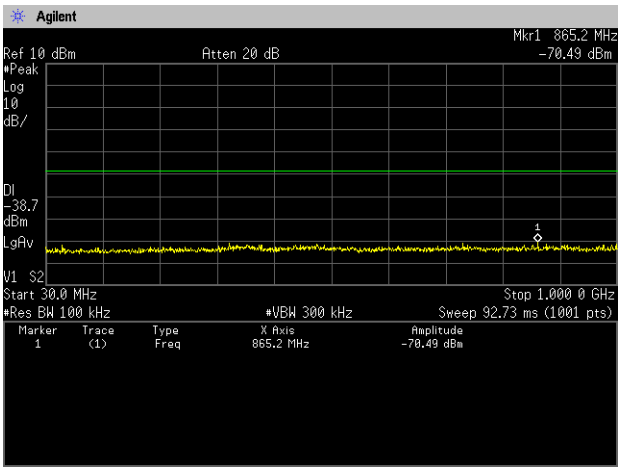


Zacta

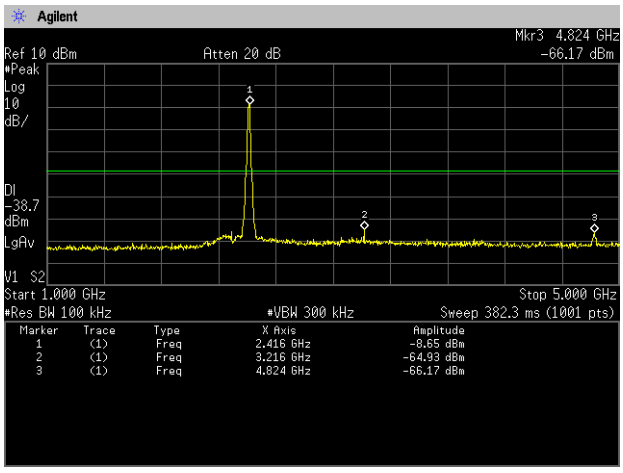
[IEEE802.11g]

Channel Low

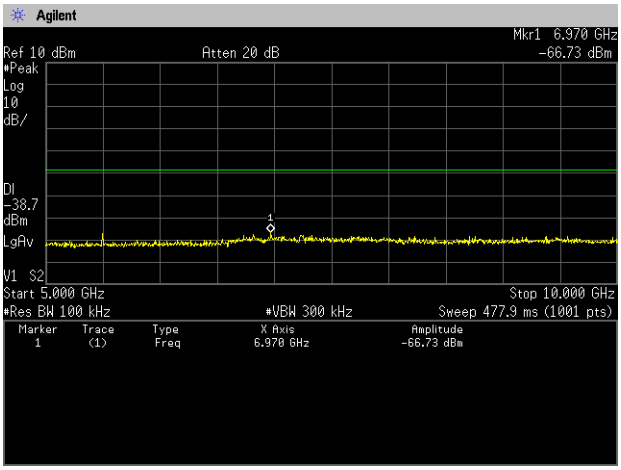
30MHz-1GHz



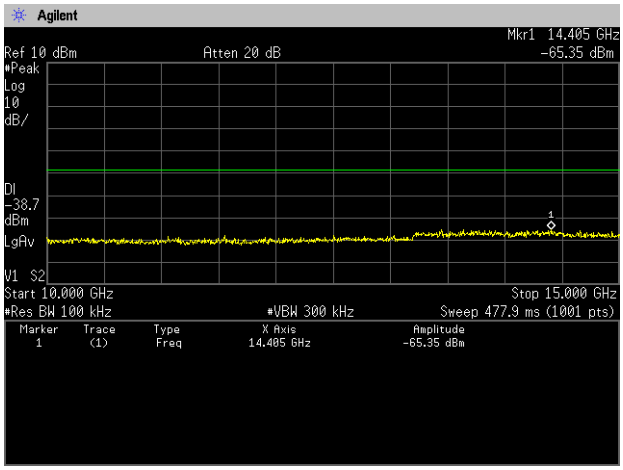
1GHz-5GHz



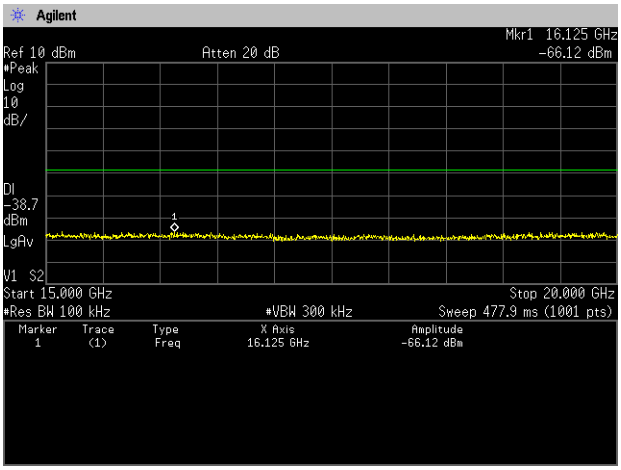
5GHz-10GHz



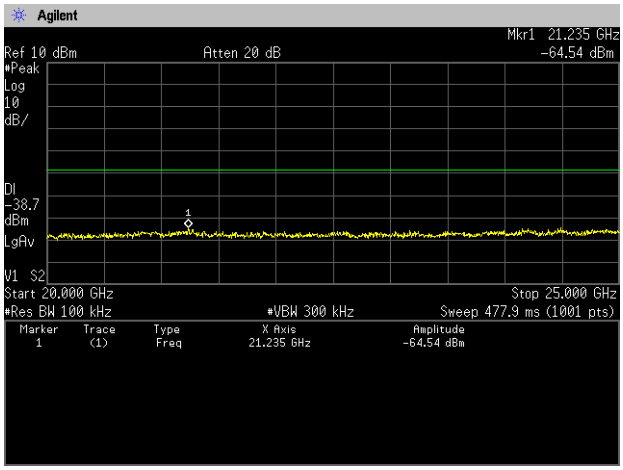
10GHz-15GHz



15GHz-20GHz

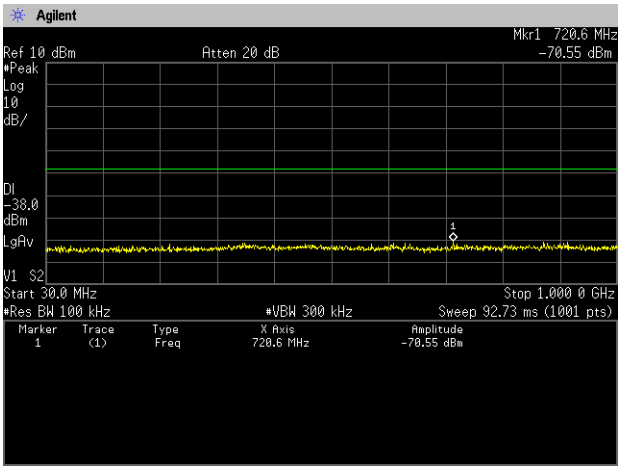


20GHz-25GHz

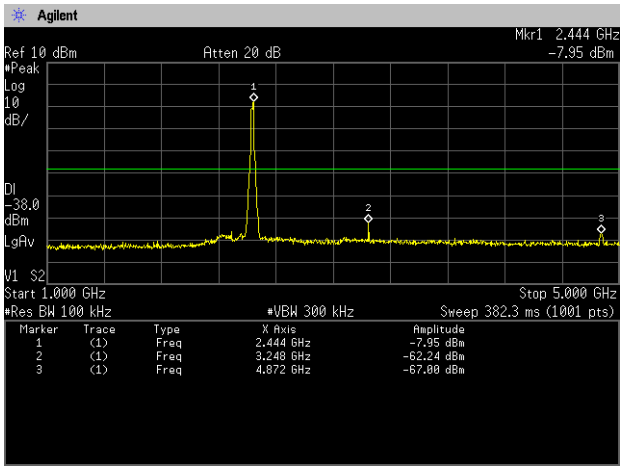


Channel Middle

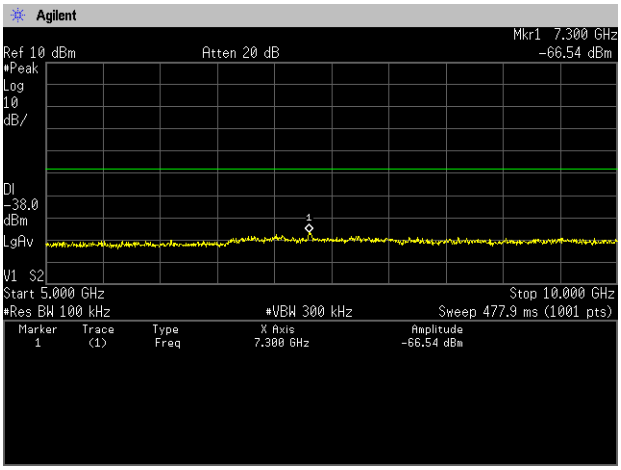
30MHz-1GHz



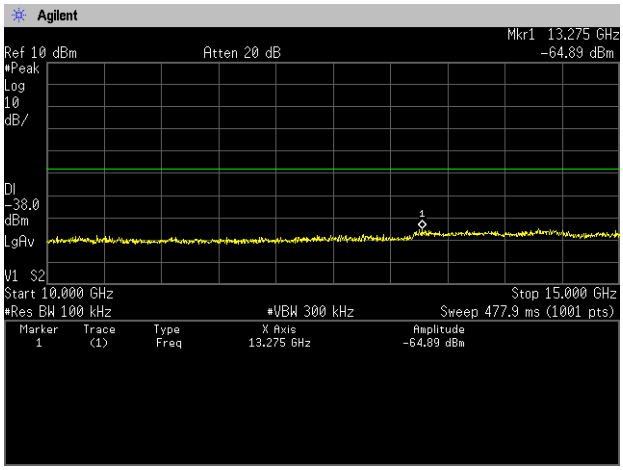
1GHz-5GHz



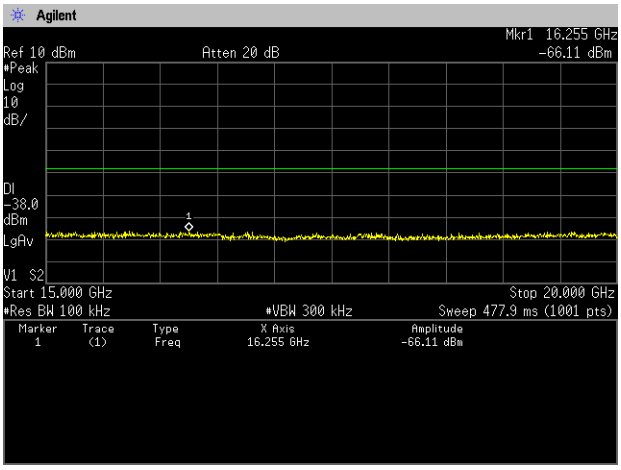
5GHz-10GHz



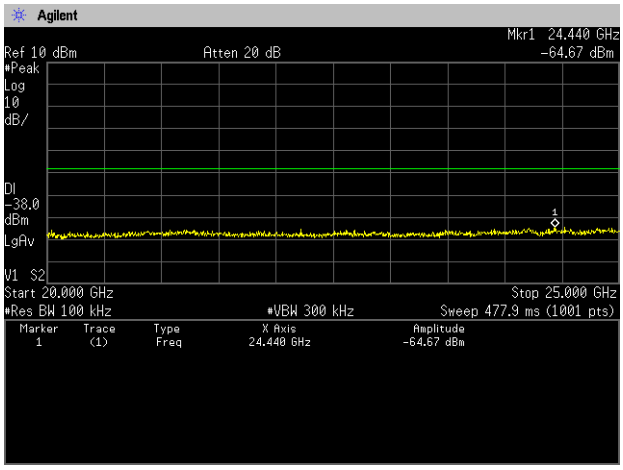
10GHz-15GHz



15GHz-20GHz



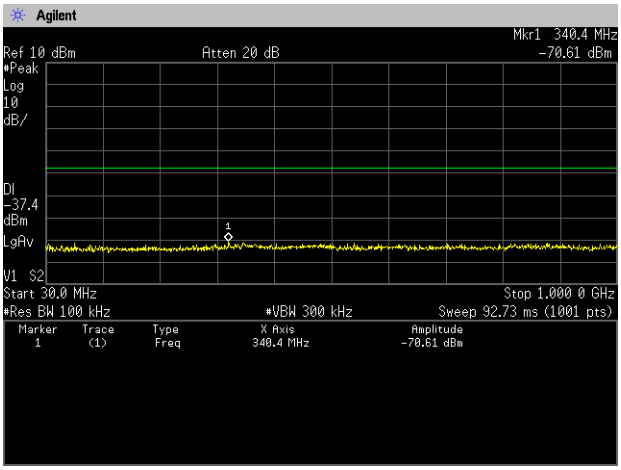
20GHz-25GHz



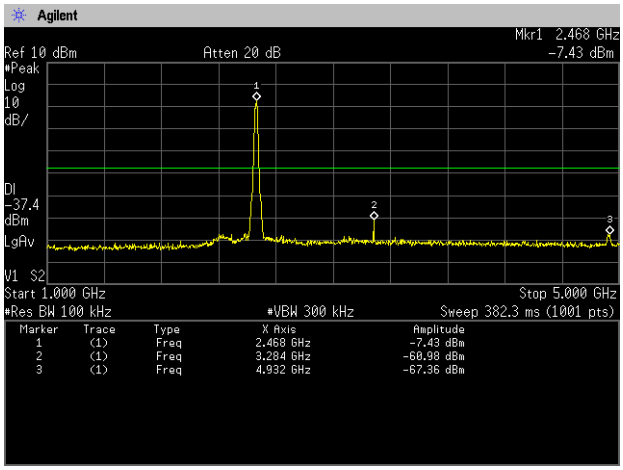
Zacta

Channel High

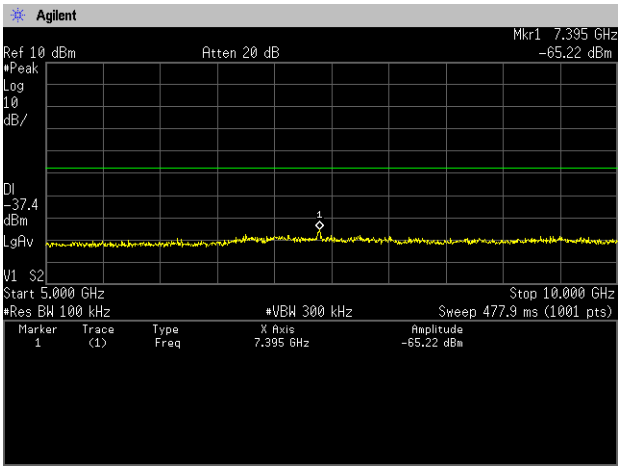
30MHz-1GHz



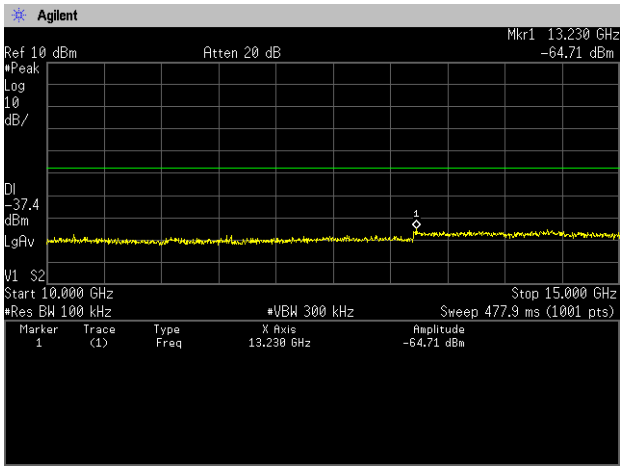
1GHz-5GHz



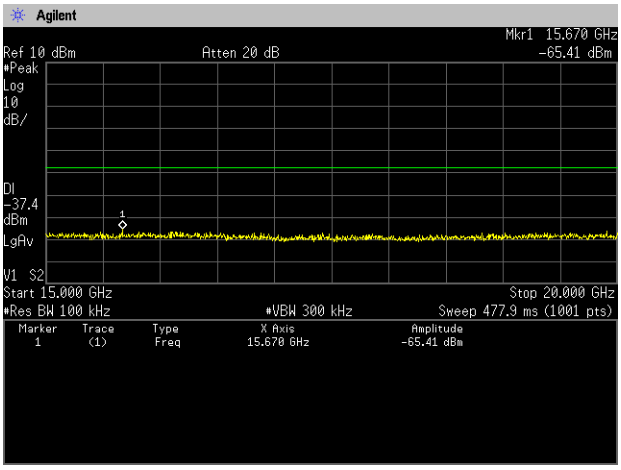
5GHz-10GHz



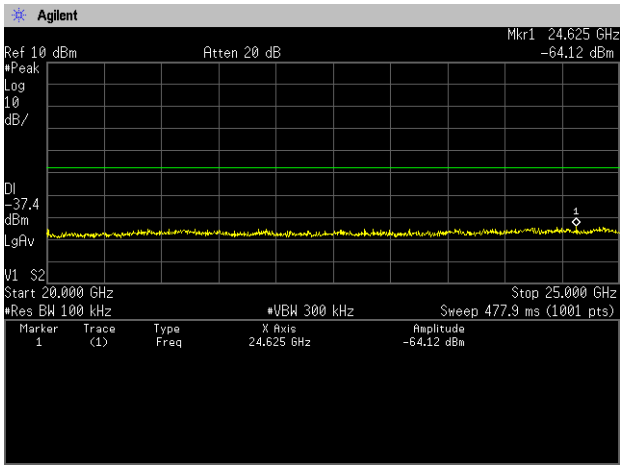
10GHz-15GHz



15GHz-20GHz



20GHz-25GHz

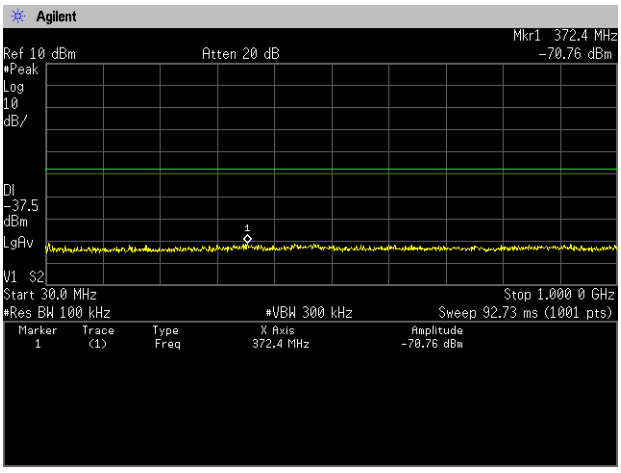


Zacta

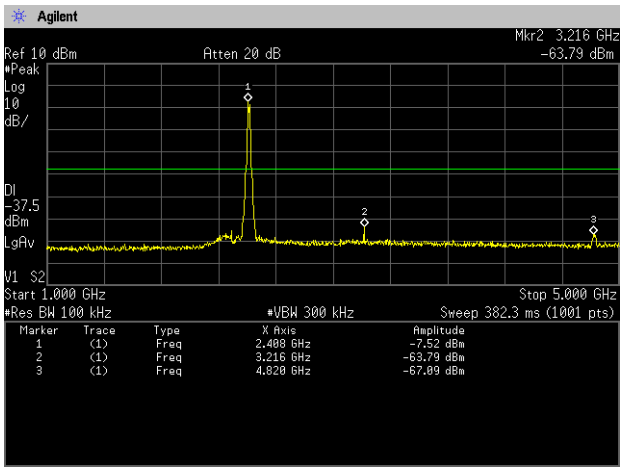
[IEEE802.11n (HT20)]

Channel Low

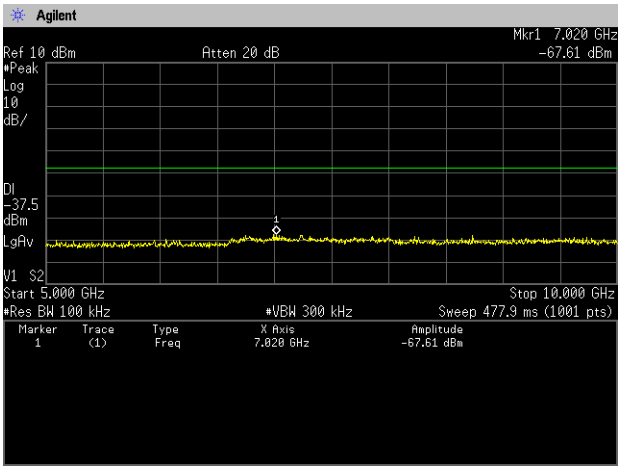
30MHz-1GHz



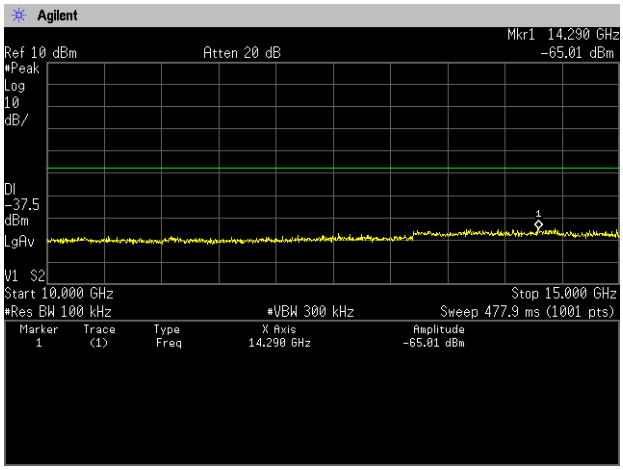
1GHz-5GHz



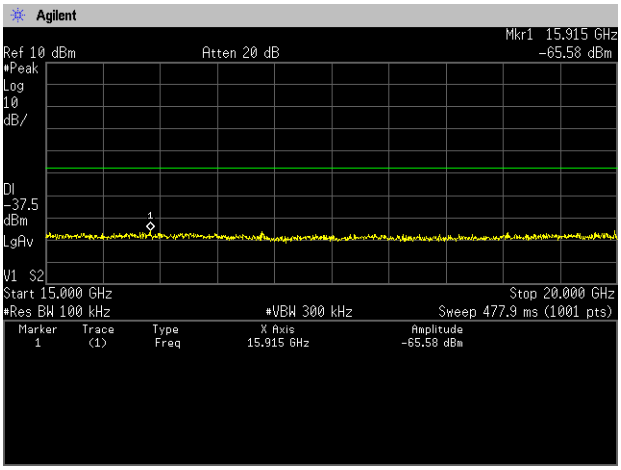
5GHz-10GHz



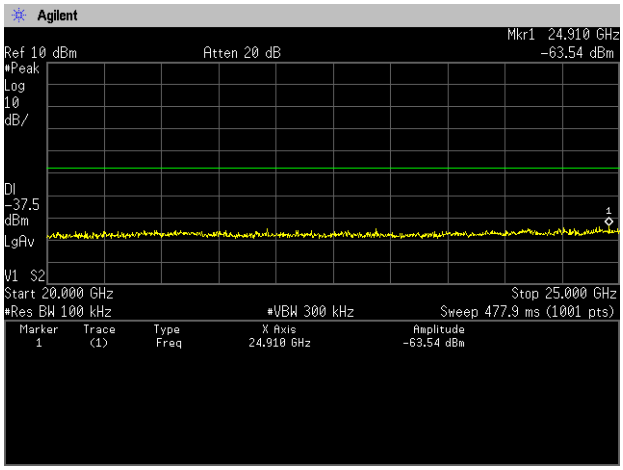
10GHz-15GHz



15GHz-20GHz

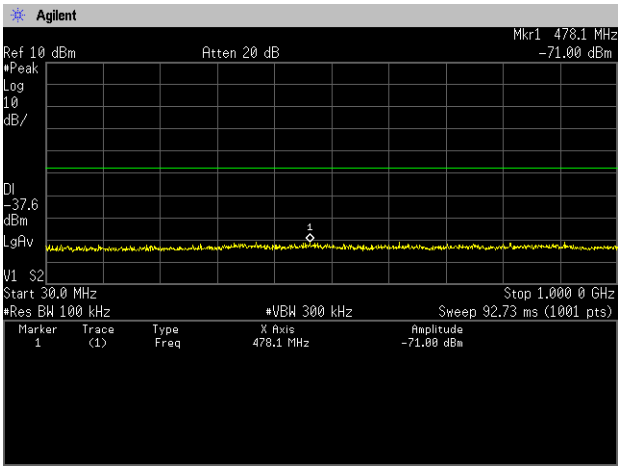


20GHz-25GHz

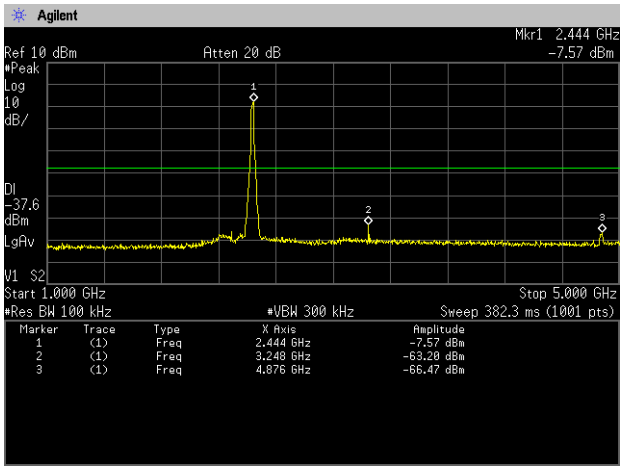


Channel Middle

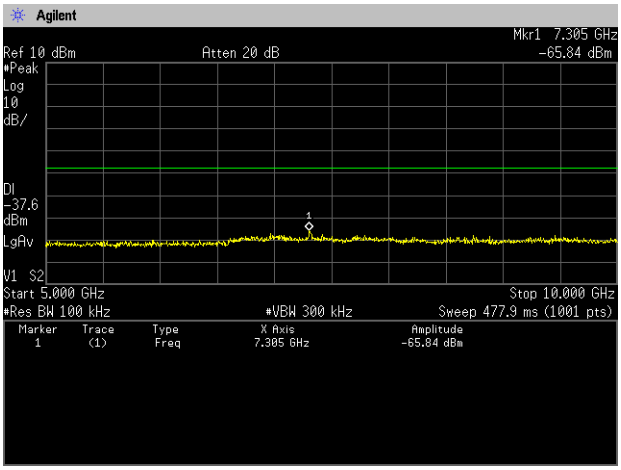
30MHz-1GHz



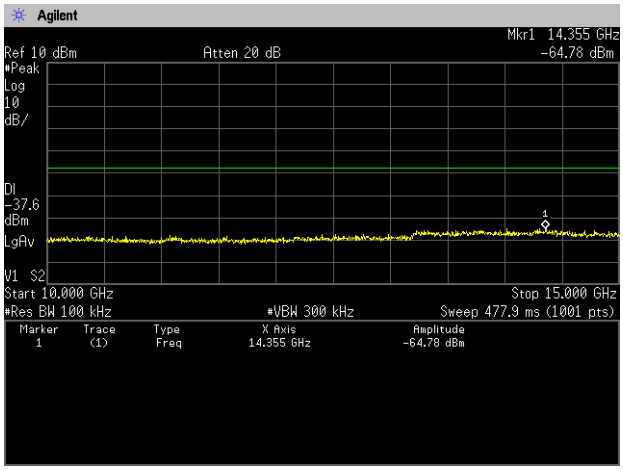
1GHz-5GHz



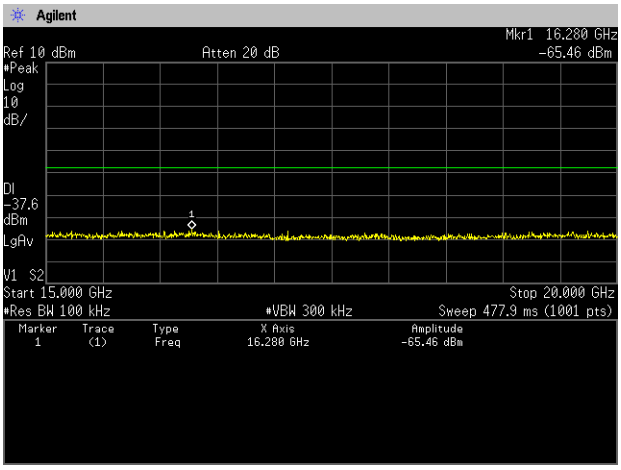
5GHz-10GHz



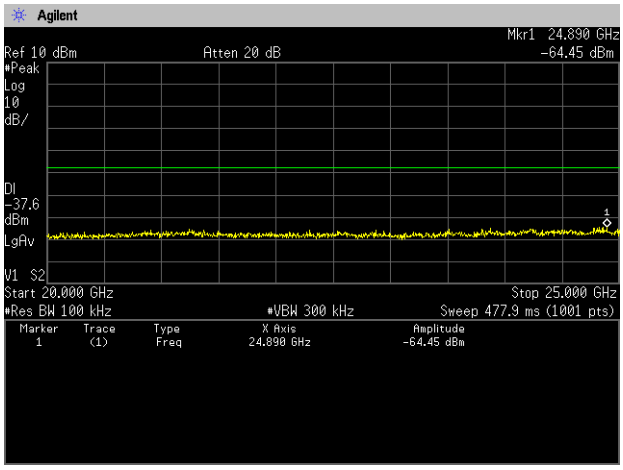
10GHz-15GHz



15GHz-20GHz



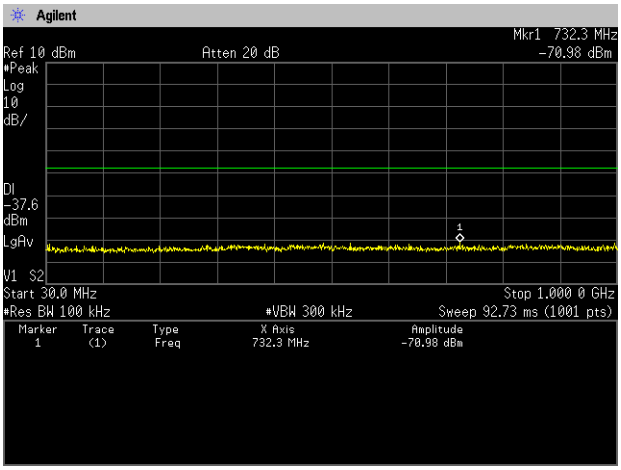
20GHz-25GHz



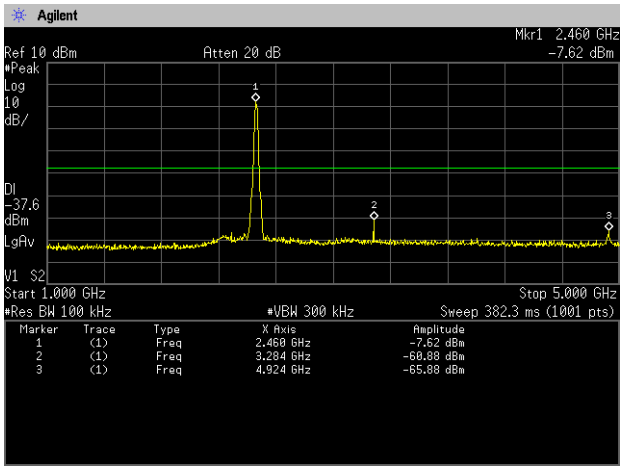
Zacta

Channel High

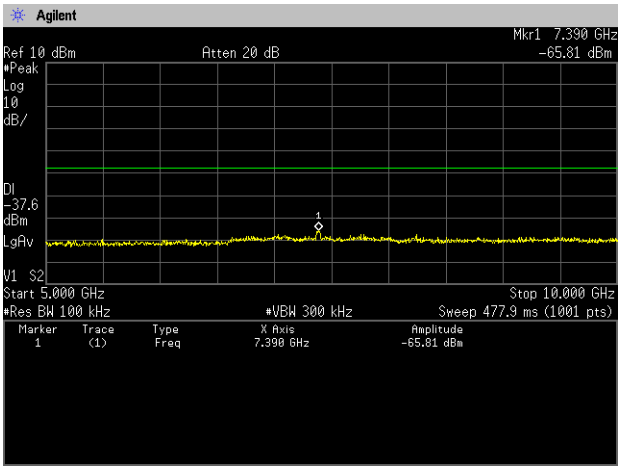
30MHz-1GHz



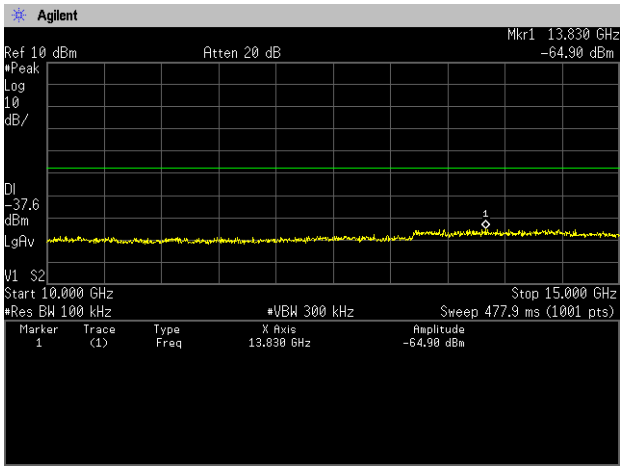
1GHz-5GHz



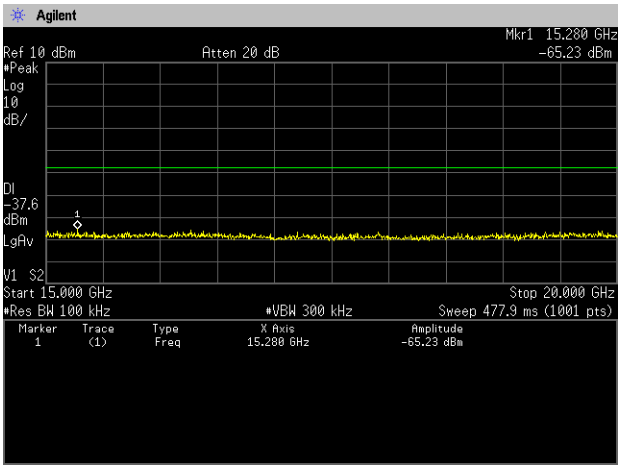
5GHz-10GHz



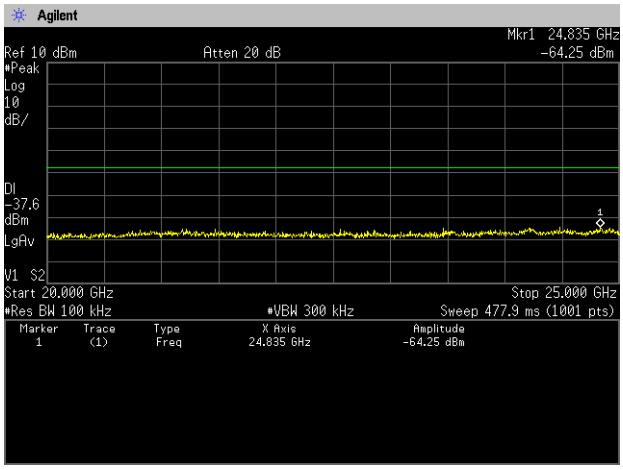
10GHz-15GHz



15GHz-20GHz



20GHz-25GHz



Zacta

8. Spurious Emissions - Radiated -

8.1 Measurement procedure
[FCC 15.247(d), 15,205, 15.209, RSS-Gen 8.9, KDB 558074 D01 v03r04, Section 12.0]

Test was applied by following conditions.

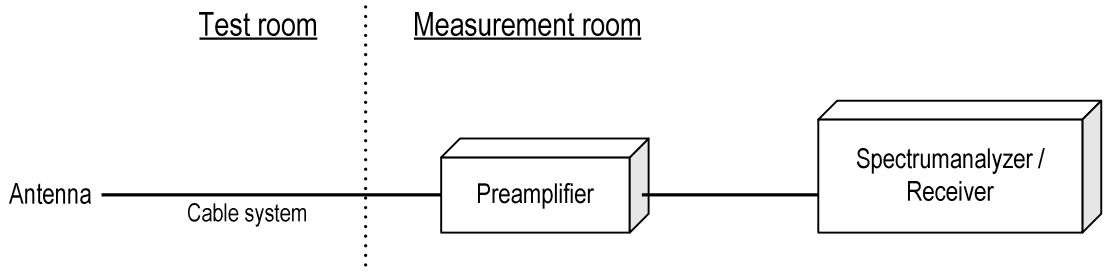
Test method	:	ANSI C63.10
Frequency range	:	9kHz to 25GHz
Test place	:	10m Semi-anechoic chamber No.1
EUT was placed on	:	FRP table / (W)2.0m × (D)1.0m × (H)0.8m (below 1GHz) Styrofoam table / (W)1.5m × (D)1.0m ×(H)1.5m (above 1GHz)
Antenna distance	:	3m
Test receiver setting		Below 1GHz
- Detector	:	Average (9kHz-90kHz, 110kHz-490kHz), Quasi-peak
- Bandwidth	:	200Hz, 120kHz
Spectrum analyzer setting		Above 1GHz
- Peak	:	RBW=1MHz, VBW=3MHz, Span=0Hz, Sweep=auto
- Average	:	RBW=1MHz, VBW=10Hz, Span=0Hz,Sweep=auto Display mode=Linear (Duty Cycle □ 98%) RBW=1MHz, VBW=1kHz, Span=0Hz,Sweep=auto Display mode=Linear (VBW = 1 / Ton)

Average Measurement Setting [VBW]

Mode	Duty Cycle (%)	T_{on} (us)	T_{off} (us)	Determined VBW Setting
IEEE802.11b	99.51	8190	40	10Hz (Duty Cycle □ 98%)
IEEE802.11g	96.45	1360	50	1kHz (VBW = 1 / Ton)
IEEE802.11n(HT20)	96.22	1272	50	1kHz (VBW = 1 / Ton)

Radiated emission measurements are performed at 3m distance with the broadband antenna (Loop antenna, Biconical antenna, Log periodic antenna, Double ridged guide antenna and Bload-band horn horn Antenna). The antenna is positioned both the horizontal and vertical planes of polarization and height is varied 1m to 4m and stopped at height producing the maximum emission. As for the Loop antenna, it is positioned with its plane vertical, and the center of the Loop antenna is 1m above the ground plane.
The EUT is Placed on a turntable, which is 0.8m (below 1GHz) and 1.5m (above 1GHz) above ground plane. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level. The test results represent the worst case emission for each emission with manipulating the EUT, support equipment, interconnecting cables and varying the mode of operation. Sufficient time for the EUT, support equipment, and test equipment are allowed in order for them to warm up to their normal operating condition.

- Test configuration



8.2 Calculation method

[9kHz to 150kHz]
Emission level = Reading + (Ant. factor + Cable system loss)
Margin = Limit – Emission level

[150kHz to 25GHz]
Emission level = Reading + (Ant. factor + Cable system loss – Amp. Gain)
Margin = Limit – Emission level

Example:
Limit @ 4804.0MHz : 74.0dBuV/m (Peak Limit)
S.A Reading = 39.9dBuV Cable system loss = 8.3dB
Result = 39.9 + 8.3 = 48.2dBuV/m
Margin = 74.0 - 48.2 = 25.8dB

8.3 Limit

Frequency [MHz]	Field strength		Distance [m]
	[uV/m]	[dBuV/m]	
0.009-0.490	2400 / F [kHz]	20logE [uV/m]	300
0.490-1.705	24000 / F [kHz]	20logE [uV/m]	30
1.705-30	30	29.5	30
30-88	100	40.0	3
88-216	150	43.5	3
216-960	200	46.0	3
Above 960	500	54.0	3

Note:
1. The lower limit shall apply at the transition frequencies.
2. Emission level [dBuV/m] = 20log Emission [uV/m]
3. As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on average detector, however, the peak field strength of any emission shall not exceed the maximum permitted average limits, specified above by more than 20dB under any condition modulation.

Zacta

8.4 Test data

Date	:	January 5, 2016			
Temperature	:	20.3 [˚C]			
Humidity	:	48.3 [%]	Test engineer	:	
Test place	:	10m Semi-anechoic chamber No.1			Hikaru Shibata

Date	:	January 15, 2016			
Temperature	:	23.2 [˚C]			
Humidity	:	49.3 [%]	Test engineer	:	
Test place	:	10m Semi-anechoic chamber No.1			Hikaru Shibata

Date	:	January 18, 2016			
Temperature	:	20.7 [˚C]			
Humidity	:	46.6 [%]	Test engineer	:	
Test place	:	10m Semi-anechoic chamber No.1			Hikaru Shibata

Date	:	January 21, 2016			
Temperature	:	22.1 [˚C]			
Humidity	:	45.3 [%]	Test engineer	:	
Test place	:	10m Semi-anechoic chamber No.1			Hikaru Shibata

Note:
Spurious plot data, please refer to Appendix C.

Zacta

[IEEE802.11b]
Channel Low

No.	Frequency	(P)	Reading QP	c.f	Result QP	Limit QP	Margin QP	Height	Angle
	[MHz]		[dB(μV)]	[dB(1/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB]	[cm]	[°]
1	34.900	V	33.2	-5.9	27.3	40.0	12.7	100.0	223.0
2	47.900	V	42.9	-10.5	32.4	40.0	7.6	100.0	152.0
3	124.900	H	48.2	-7.8	40.4	43.5	3.1	238.0	118.0
4	240.000	H	41.3	-3.4	37.9	46.0	8.1	100.0	300.0
5	478.100	H	41.2	-5.2	36.0	46.0	10.0	100.0	222.0
6	720.100	H	42.9	-1.3	41.6	46.0	4.4	101.0	165.0
7	960.200	H	44.1	2.1	46.2	54.0	7.8	100.0	295.0

No.	Frequency	(P)	Reading PK	Reading CAV	c.f	Result PK	Result CAV	Limit PK	Limit AV	Margin PK	Margin CAV	Height	Angle
	[MHz]		[dB(μV)]	[dB(μV)]	[dB(1/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB]	[dB]	[cm]	[°]
1	4824.000	H	43.5	35.1	14.9	58.4	50.0	74.0	54.0	15.6	4.0	120.0	35.0
2	4824.000	V	43.6	34.9	14.9	58.5	49.8	74.0	54.0	15.5	4.2	100.0	196.0

Channel Middle

No.	Frequency	(P)	Reading QP	c.f	Result QP	Limit QP	Margin QP	Height	Angle
	[MHz]		[dB(μV)]	[dB(1/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB]	[cm]	[°]
1	35.000	V	33.3	-5.9	27.4	40.0	12.6	100.0	220.0
2	47.900	V	43.2	-10.5	32.7	40.0	7.3	100.0	149.0
3	125.000	H	47.3	-7.8	39.5	43.5	4.0	212.0	120.0
4	240.000	H	42.1	-3.4	38.7	46.0	7.3	100.0	198.0
5	480.000	H	42.0	-5.2	36.8	46.0	9.2	100.0	212.0
6	720.100	H	42.6	-1.3	41.3	46.0	4.7	101.0	179.0
7	960.200	H	43.7	2.1	45.8	54.0	8.2	100.0	282.0

No.	Frequency	(P)	Reading PK	Reading CAV	c.f	Result PK	Result CAV	Limit PK	Limit AV	Margin PK	Margin CAV	Height	Angle
	[MHz]		[dB(μV)]	[dB(μV)]	[dB(1/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB]	[dB]	[cm]	[°]
1	4874.000	H	44.1	36.1	15.0	59.1	51.1	74.0	54.0	14.9	2.9	120.0	45.0
2	4874.000	V	43.2	34.9	15.0	58.2	49.9	74.0	54.0	15.8	4.1	102.0	156.0

Channel High

No.	Frequency	(P)	Reading QP	c.f	Result QP	Limit QP	Margin QP	Height	Angle
	[MHz]		[dB(μV)]	[dB(1/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB]	[cm]	[°]
1	34.900	V	32.8	-5.9	26.9	40.0	13.1	100.0	220.0
2	47.900	V	42.5	-10.5	32.0	40.0	8.0	100.0	172.0
3	125.000	H	45.9	-7.8	38.1	43.5	5.4	201.0	118.0
4	240.000	H	42.8	-3.4	39.4	46.0	6.6	100.0	300.0
5	480.000	H	42.7	-5.2	37.5	46.0	8.5	100.0	218.0
6	720.100	H	43.7	-1.3	42.4	46.0	3.6	101.0	174.0
7	960.200	H	43.2	2.1	45.3	54.0	8.7	100.0	288.0

No.	Frequency	(P)	Reading PK	Reading CAV	c.f	Result PK	Result CAV	Limit PK	Limit AV	Margin PK	Margin CAV	Height	Angle
	[MHz]		[dB(μV)]	[dB(μV)]	[dB(1/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB]	[dB]	[cm]	[°]
1	4924.000	H	43.8	36.9	15.2	59.0	52.1	74.0	54.0	15.0	1.9	148.0	48.0
2	4924.000	V	43.9	34.9	15.2	59.1	50.1	74.0	54.0	14.9	3.9	147.0	192.0

Note:
1. Emission Level (Margin) = Limit - [Reading + Factor (Antenna + Cable – Amp)]

Zacta

[IEEE802.11g]

Channel Low

No.	Frequency [MHz]	(P)	Reading QP [dB(μV)]	c.f [dB(1/m)]	Result QP [dB(μV/m)]	Limit QP [dB(μV/m)]	Margin QP [dB]	Height [cm]	Angle [°]
1	33.600	V	41.8	-5.5	36.3	40.0	3.7	100.0	320.0
2	47.800	V	45.2	-10.4	34.8	40.0	5.2	100.0	113.0
3	125.000	V	46.2	-7.8	38.4	43.5	5.1	100.0	181.0
4	204.500	H	41.6	-4.0	37.6	43.5	5.9	100.0	225.0
5	240.400	H	40.9	-3.4	37.5	46.0	8.5	188.0	3.0
6	476.080	H	43.6	-5.2	38.4	46.0	7.6	100.0	199.0
7	720.100	H	44.1	-1.3	42.8	46.0	3.2	100.0	221.0
8	960.200	H	39.0	2.1	41.1	54.0	12.9	189.0	143.0

No.	Frequency [MHz]	(P)	Reading PK [dB(μV)]	Reading CAV [dB(μV)]	c.f [dB(1/m)]	Result PK [dB(μV/m)]	Result CAV [dB(μV/m)]	Limit PK [dB(μV/m)]	Limit AV [dB(μV/m)]	Margin PK [dB]	Margin CAV [dB]	Height [cm]	Angle [°]
1	4824.000	H	42.5	29.0	14.9	57.4	43.9	74.0	54.0	16.6	10.1	150.0	54.0
2	4824.000	V	43.8	29.4	14.9	58.7	44.3	74.0	54.0	15.3	9.7	152.0	164.0

Channel Middle

No.	Frequency [MHz]	(P)	Reading QP [dB(μV)]	c.f [dB(1/m)]	Result QP [dB(μV/m)]	Limit QP [dB(μV/m)]	Margin QP [dB]	Height [cm]	Angle [°]
1	33.200	V	36.5	-5.3	31.2	40.0	8.8	100.0	325.0
2	47.800	V	43.2	-10.4	32.8	40.0	7.2	100.0	113.0
3	124.900	V	47.6	-7.8	39.8	43.5	3.7	100.0	180.0
4	204.200	H	40.2	-4.0	36.2	43.5	7.3	100.0	221.0
5	240.400	H	41.0	-3.4	37.6	46.0	8.4	190.0	0.0
6	476.800	H	42.8	-5.2	37.6	46.0	8.4	100.0	191.0
7	720.100	H	44.0	-1.3	42.7	46.0	3.3	100.0	222.0
8	960.300	H	39.2	2.1	41.3	54.0	12.7	191.0	152.0

No.	Frequency [MHz]	(P)	Reading PK [dB(μV)]	Reading CAV [dB(μV)]	c.f [dB(1/m)]	Result PK [dB(μV/m)]	Result CAV [dB(μV/m)]	Limit PK [dB(μV/m)]	Limit AV [dB(μV/m)]	Margin PK [dB]	Margin CAV [dB]	Height [cm]	Angle [°]
1	4874.000	H	43.9	29.8	15.0	58.9	44.8	74.0	54.0	15.1	9.2	100.0	49.0
2	4874.000	V	42.5	29.2	15.0	57.5	44.2	74.0	54.0	16.5	9.8	100.0	190.0

Channel High

No.	Frequency [MHz]	(P)	Reading QP [dB(μV)]	c.f [dB(1/m)]	Result QP [dB(μV/m)]	Limit QP [dB(μV/m)]	Margin QP [dB]	Height [cm]	Angle [°]
1	33.200	V	36.5	-5.3	31.2	40.0	8.8	100.0	325.0
2	47.800	V	42.5	-10.4	32.1	40.0	7.9	100.0	116.0
3	125.000	V	47.1	-7.8	39.3	43.5	4.2	100.0	178.0
4	204.200	H	40.2	-4.0	36.2	43.5	7.3	100.0	221.0
5	240.400	H	41.0	-3.4	37.6	46.0	8.4	190.0	0.0
6	478.100	H	43.1	-5.2	37.9	46.0	8.1	100.0	188.0
7	720.100	H	43.5	-1.3	42.2	46.0	3.8	100.0	215.0
8	960.100	H	40.1	2.1	42.2	54.0	11.8	187.0	156.0

No.	Frequency [MHz]	(P)	Reading PK [dB(μV)]	Reading CAV [dB(μV)]	c.f [dB(1/m)]	Result PK [dB(μV/m)]	Result CAV [dB(μV/m)]	Limit PK [dB(μV/m)]	Limit AV [dB(μV/m)]	Margin PK [dB]	Margin CAV [dB]	Height [cm]	Angle [°]
1	4924.000	H	41.8	28.4	15.2	57.0	43.6	74.0	54.0	17.0	10.4	149.0	238.0
2	4924.000	V	43.5	29.8	15.2	58.7	45.0	74.0	54.0	15.3	9.0	145.0	165.0

Note:

1. Emission Level (Margin) = Limit - [Reading + Factor (Antenna + Cable – Amp)]

Zacta

[IEEE802.11n (HT20)]
Channel Low

No.	Frequency	(P)	Reading QP	c.f	Result QP	Limit QP	Margin QP	Height	Angle
	[MHz]		[dB(μV)]	[dB(1/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB]	[cm]	[°]
1	35.010	V	34.4	-5.9	28.5	40.0	11.5	100.0	236.0
2	51.800	V	43.6	-11.8	31.8	40.0	8.2	100.0	204.0
3	125.000	H	46.8	-7.8	39.0	43.5	4.5	350.0	101.0
4	240.400	H	40.9	-3.4	37.5	46.0	8.5	188.0	3.0
5	476.080	H	43.6	-5.2	38.4	46.0	7.6	100.0	199.0
6	720.100	H	44.1	-1.3	42.8	46.0	3.2	100.0	221.0
7	960.200	H	39.0	2.1	41.1	54.0	12.9	189.0	143.0

No.	Frequency	(P)	Reading PK	Reading CAV	c.f	Result PK	Result CAV	Limit PK	Limit AV	Margin PK	Margin CAV	Height	Angle
	[MHz]		[dB(μV)]	[dB(μV)]	[dB(1/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB]	[dB]	[cm]	[°]
1	4824.000	H	42.3	28.9	14.9	57.2	43.8	74.0	54.0	16.8	10.2	100.0	54.0
2	4824.000	V	44.1	32.1	14.9	59.0	47.0	74.0	54.0	15.0	7.0	142.0	158.0

Channel Middle

No.	Frequency	(P)	Reading QP	c.f	Result QP	Limit QP	Margin QP	Height	Angle
	[MHz]		[dB(μV)]	[dB(1/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB]	[cm]	[°]
1	35.020	V	34.3	-5.9	28.4	40.0	11.6	100.0	229.0
2	51.800	V	43.4	-11.8	31.6	40.0	8.4	100.0	204.0
3	125.000	H	45.8	-7.8	38.0	43.5	5.5	346.0	112.0
4	240.000	H	41.0	-3.4	37.6	46.0	8.4	172.0	92.0
5	476.400	H	43.1	-5.2	37.9	46.0	8.1	100.0	192.0
6	720.000	H	43.7	-1.3	42.4	46.0	3.6	100.0	224.0
7	960.000	H	40.1	2.1	42.2	46.0	3.8	190.0	146.0

No.	Frequency	(P)	Reading PK	Reading CAV	c.f	Result PK	Result CAV	Limit PK	Limit AV	Margin PK	Margin CAV	Height	Angle
	[MHz]		[dB(μV)]	[dB(μV)]	[dB(1/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB]	[dB]	[cm]	[°]
1	4874.000	H	43.4	29.3	15.0	58.4	44.3	74.0	54.0	15.6	9.7	123.0	42.0
2	4874.000	V	42.1	28.9	15.0	57.1	43.9	74.0	54.0	16.9	10.1	100.0	195.0

Channel High

No.	Frequency	(P)	Reading QP	c.f	Result QP	Limit QP	Margin QP	Height	Angle
	[MHz]		[dB(μV)]	[dB(1/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB]	[cm]	[°]
1	35.000	V	33.5	-5.9	27.6	40.0	12.4	100.0	230.0
2	51.800	V	43.2	-11.8	31.4	40.0	8.6	100.0	203.0
3	124.800	H	44.6	-7.8	36.8	43.5	6.7	101.0	110.0
4	240.000	H	41.2	-3.4	37.8	46.0	8.2	182.0	181.0
5	476.000	H	43.2	-5.2	38.0	46.0	8.0	100.0	199.0
6	720.300	H	43.8	-1.3	42.5	46.0	3.5	100.0	221.0
7	960.100	H	40.1	2.1	42.2	54.0	11.8	185.0	140.0

No.	Frequency	(P)	Reading PK	Reading CAV	c.f	Result PK	Result CAV	Limit PK	Limit AV	Margin PK	Margin CAV	Height	Angle
	[MHz]		[dB(μV)]	[dB(μV)]	[dB(1/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB(μV/m)]	[dB]	[dB]	[cm]	[°]
1	4924.000	H	41.1	28.2	15.2	56.3	43.4	74.0	54.0	17.7	10.6	100.0	243.0
2	4924.000	V	41.4	28.4	15.2	56.6	43.6	74.0	54.0	17.4	10.4	100.0	195.0

Note:
1. Emission Level (Margin) = Limit - [Reading + Factor (Antenna + Cable – Amp)]

Zacta

[Receive mode]

Channel Low

No.	Frequency [MHz]	(P)	Reading QP [dB(μV)]	c.f [dB(1/m)]	Result QP [dB(μV/m)]	Limit QP [dB(μV/m)]	Margin QP [dB]	Height [cm]	Angle [°]
1	47.800	V	41.0	-10.4	30.6	40.0	9.4	100.0	172.0
2	125.000	H	43.0	-7.8	35.2	43.5	8.3	189.0	121.0
3	235.000	H	41.0	-3.4	37.6	46.0	8.4	112.0	110.0
4	480.000	H	40.8	-5.2	35.6	46.0	10.4	100.0	171.0
5	720.100	H	43.4	-1.3	42.1	46.0	3.9	100.0	225.0

Channel Middle

No.	Frequency [MHz]	(P)	Reading QP [dB(μV)]	c.f [dB(1/m)]	Result QP [dB(μV/m)]	Limit QP [dB(μV/m)]	Margin QP [dB]	Height [cm]	Angle [°]
1	47.800	V	41.5	-10.4	31.1	40.0	8.9	100.0	171.0
2	125.000	H	44.2	-7.8	36.4	43.5	7.1	245.0	123.0
3	233.100	H	42.6	-3.5	39.1	46.0	6.9	124.0	111.0
4	479.900	H	41.7	-5.2	36.5	46.0	9.5	100.0	162.0
5	720.100	H	44.9	-1.3	43.6	46.0	2.4	114.0	232.0
6	960.200	H	43.9	2.1	46.0	54.0	8.0	100.0	185.0

Channel High

No.	Frequency [MHz]	(P)	Reading QP [dB(μV)]	c.f [dB(1/m)]	Result QP [dB(μV/m)]	Limit QP [dB(μV/m)]	Margin QP [dB]	Height [cm]	Angle [°]
1	51.900	V	39.3	-11.8	27.5	40.0	12.5	115.0	195.0
2	125.000	H	44.5	-7.8	36.7	43.5	6.8	250.0	105.0
3	232.700	H	44.0	-3.5	40.5	46.0	5.5	133.0	117.0
4	480.000	H	43.4	-5.2	38.2	46.0	7.8	191.0	322.0
5	720.100	H	43.6	-1.3	42.3	46.0	3.7	120.0	228.0
6	960.200	H	43.5	2.1	45.6	54.0	8.4	100.0	184.0

9. Restricted Band of Operation

9.1 Measurement procedure
[FCC 247(d), 15,205, 15.209, RSS-Gen 8.9, KDB 558074 D01 v03r04, Section 12.0]

Test was applied by following conditions.

Test method	:	ANSI C63.10
Test place	:	10m Semi-anechoic chamber No.1
EUT was placed on	:	Styrofoam table / (W)1.5m × (D)1.0m ×(H)1.5m (above 1GHz)
Antenna distance	:	3m

Spectrum analyzer setting

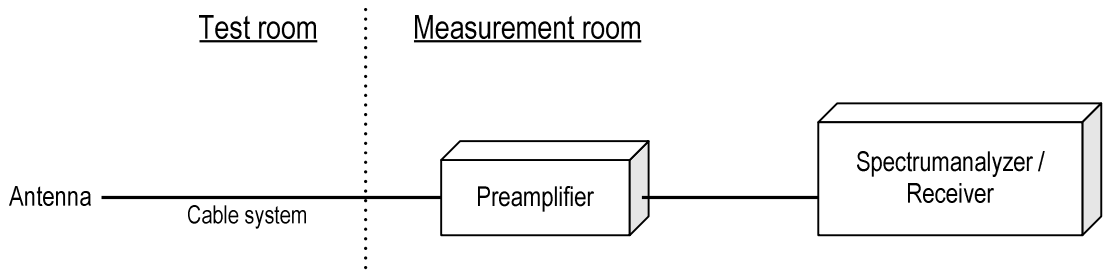
- Peak	:	RBW=1MHz, VBW=3MHz, Span=Arbitrary setting, Sweep=auto
- Average	:	RBW=1MHz, VBW=10Hz, Span=Arbitrary setting, Sweep=auto Display mode=Linear (Duty Cycle □ 98%) RBW=1MHz, VBW=1kHz, Span=Arbitrary setting, Sweep=auto Display mode=Linear (VBW = 1 / Ton)

Average Measurement Setting [VBW]

Mode	Duty Cycle (%)	T_{on} (us)	T_{off} (us)	Determined VBW Setting
IEEE802.11b	99.51	8190	40	10Hz (Duty Cycle □ 98%)
IEEE802.11g	96.45	1360	50	1kHz (VBW = 1 / Ton)
IEEE802.11n(HT20)	96.22	1272	50	1kHz (VBW = 1 / Ton)

Radiated emission measurements are performed at 3m distance with the broadband antenna (Double ridged guide antenna). The antenna is positioned both the horizontal and vertical planes of polarization and height is varied 1m to 4m and stopped at height producing the maximum emission.
The EUT is Placed on a turntable, which is 0.8m above ground plane. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level. The test results represent the worst case emission for each emission with manipulating the EUT, support equipment, interconnecting cables and varying the mode of operation. Sufficient time for the EUT, support equipment, and test equipment are allowed in order for them to warm up to their normal operating condition.

- Test configuration



Zacta

9.2 Limit

Emission at the boundary of the restricted band provided by 15.205 shall be lower than 15.209 limit.

9.3 Measurement Result

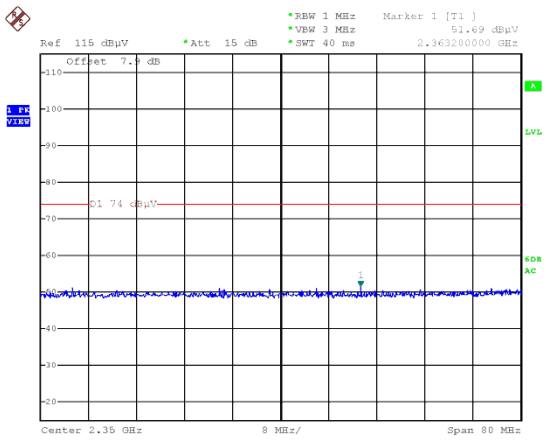
Channel	Frequency [MHz]	Results Chart	Result
Low	2412	See the Trace Data	Pass
High	2462	See the Trace Data	Pass

9.4 Test data

Date	:	January 14, 2016			
Temperature	:	23.2[˚C]			
Humidity	:	49.3 [%]	Test engineer	:	
Test place	:	3m Semi-anechoic chamber			Hikaru Shibata

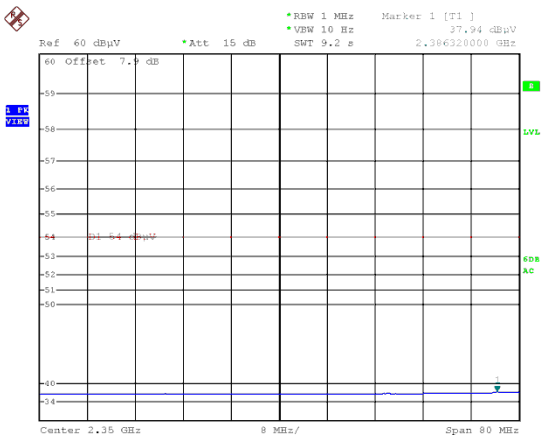
[IEEE802.11b]

Channel Low
Horizontal
Peak



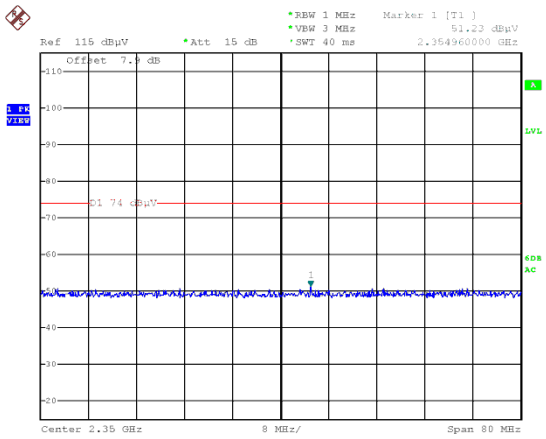
Date: 14.JAN.2016 01:06:45

Average



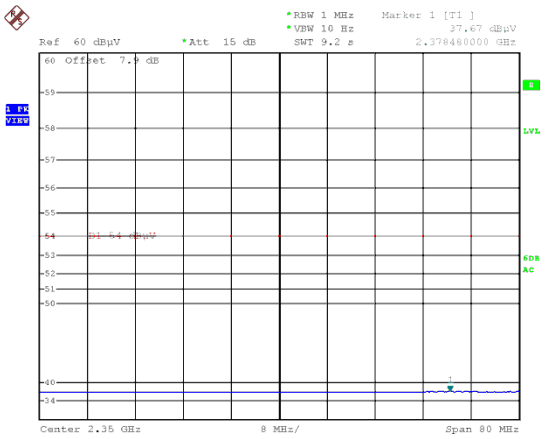
Date: 14.JAN.2016 01:05:08

Vertical
Peak



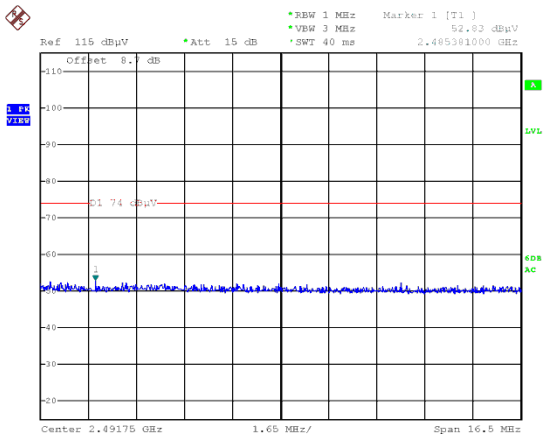
Date: 14.JAN.2016 02:38:23

Average



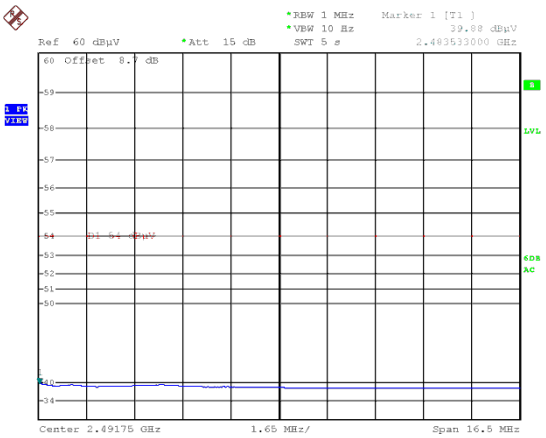
Date: 14.JAN.2016 02:37:50

Channel High
Horizontal
Peak



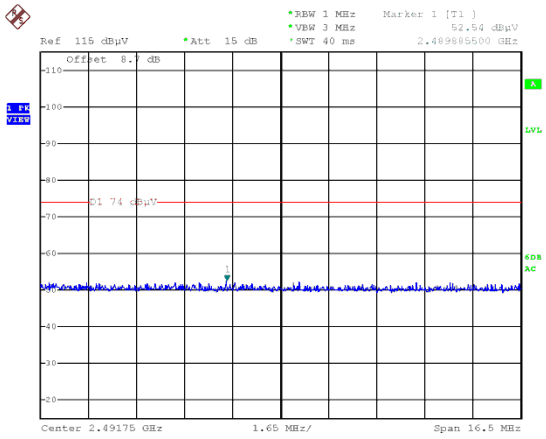
Date: 14.JAN.2016 03:55:00

Average



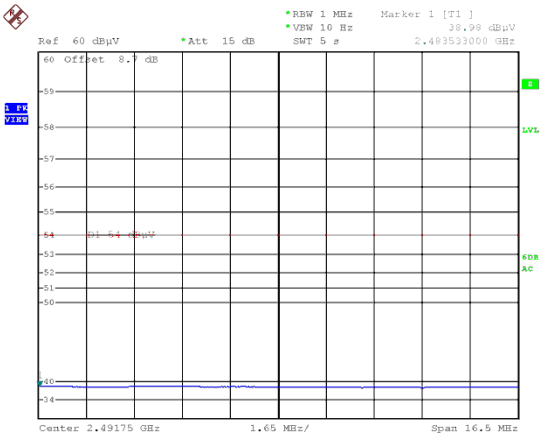
Date: 14.JAN.2016 03:54:31

Vertical
Peak



Date: 14.JAN.2016 03:59:02

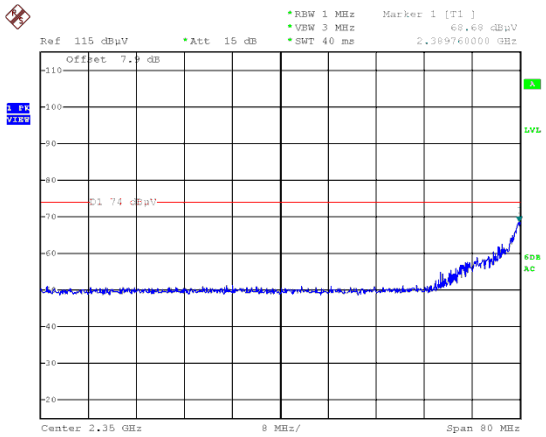
Average



Date: 14.JAN.2016 04:34:10

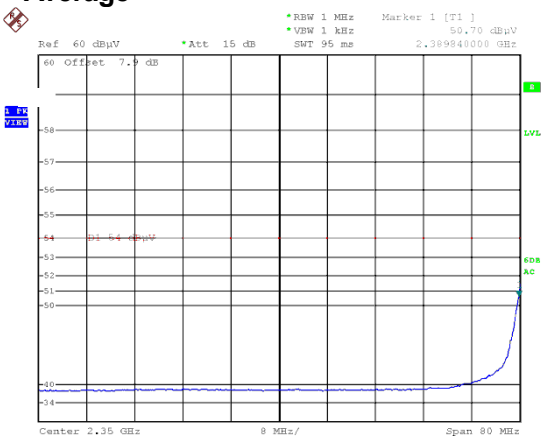
[IEEE802.11g]

Channel Low
Horizontal
Peak



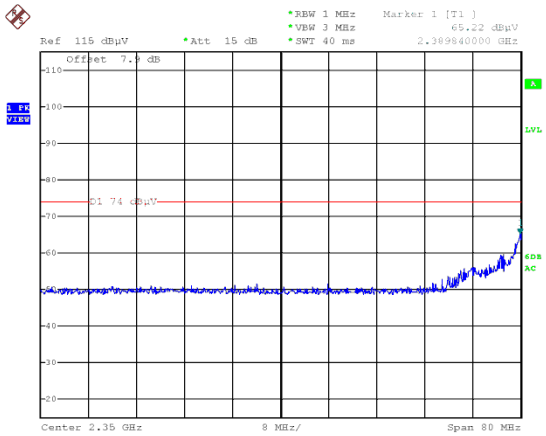
Date: 14.JAN.2016 03:44:29

Average



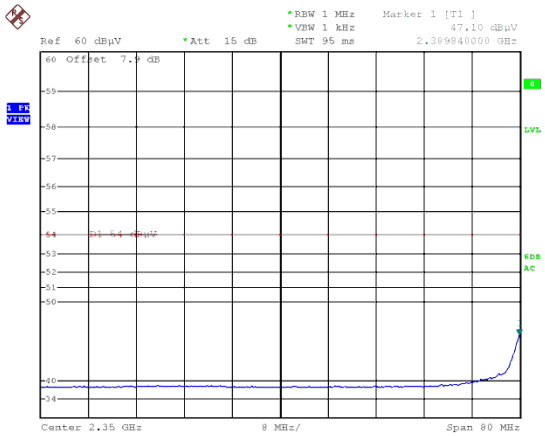
Date: 14.JAN.2016 03:43:25

Vertical
Peak



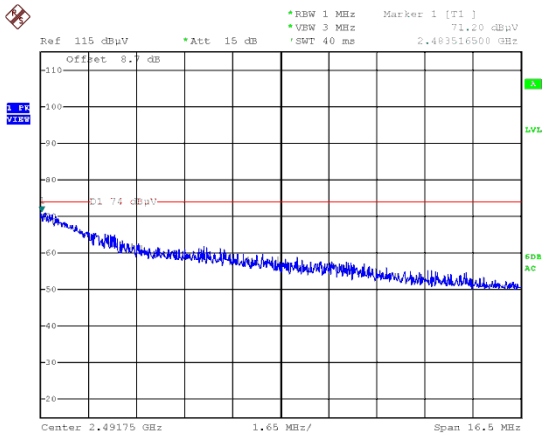
Date: 14.JAN.2016 03:39:32

Average



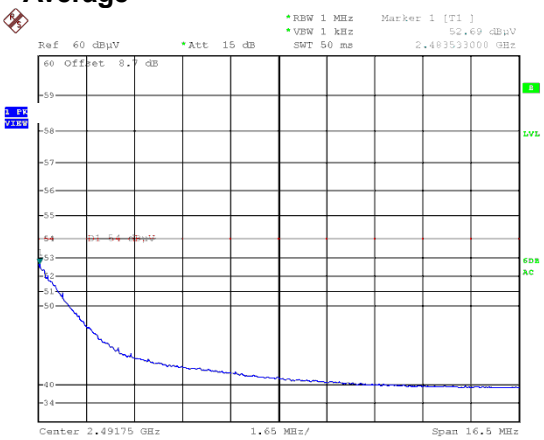
Date: 14.JAN.2016 03:40:02

Channel High
Horizontal
Peak



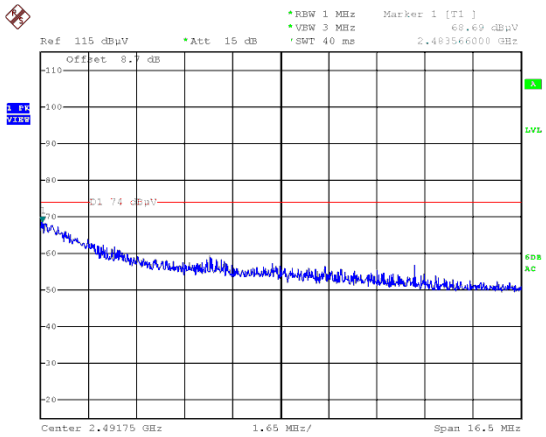
Date: 14.JAN.2016 04:08:08

Average



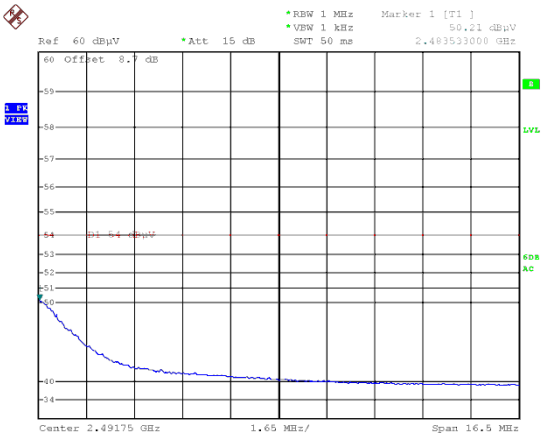
Date: 14.JAN.2016 04:07:35

Vertical
Peak



Date: 14.JAN.2016 04:04:31

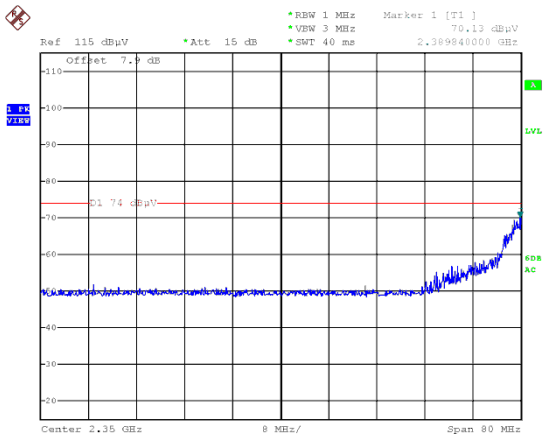
Average



Date: 14.JAN.2016 04:03:48

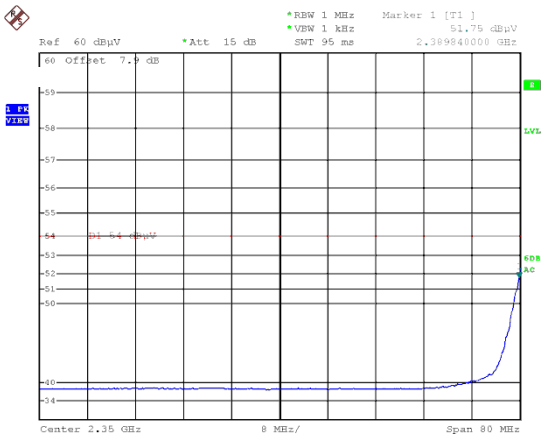
[IEEE802.11n (HT20)]

Channel Low
Horizontal
Peak



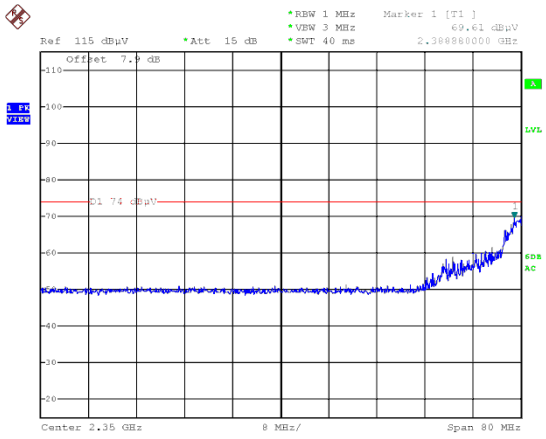
Date: 14.JAN.2016 03:31:13

Average



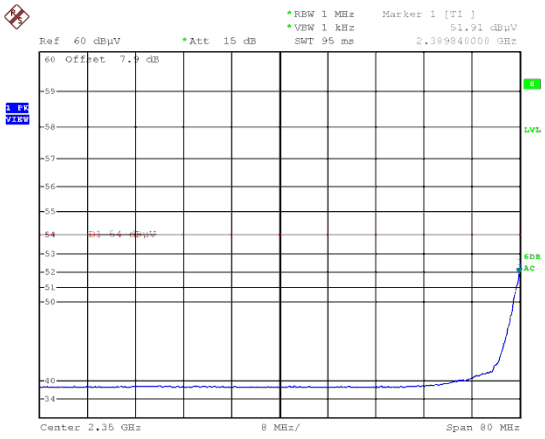
Date: 14.JAN.2016 03:30:18

Vertical
Peak



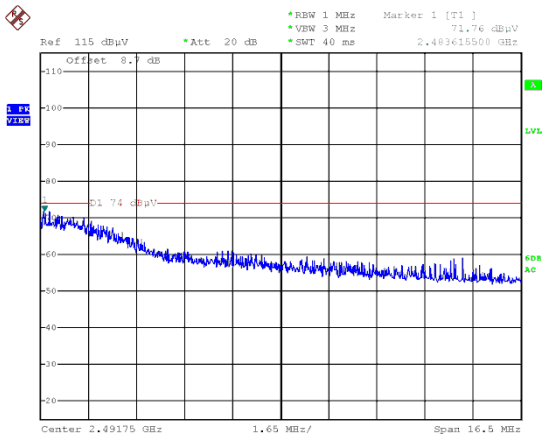
Date: 14.JAN.2016 03:35:27

Average



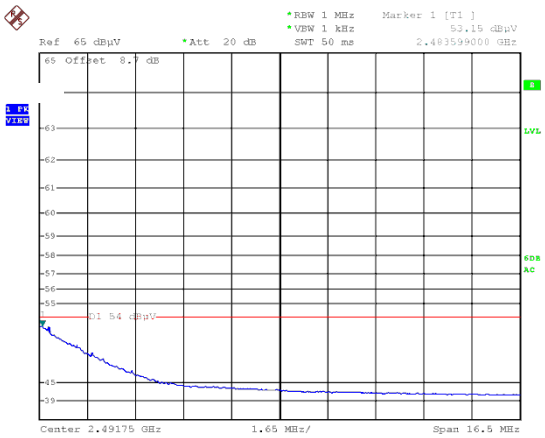
Date: 14.JAN.2016 03:34:19

Channel High
Horizontal
Peak



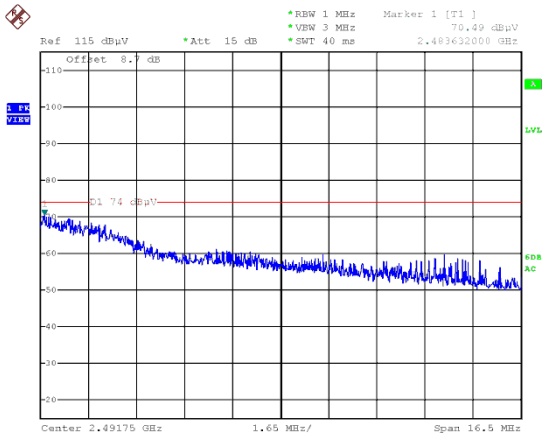
Date: 14.JAN.2016 04:15:38

Average



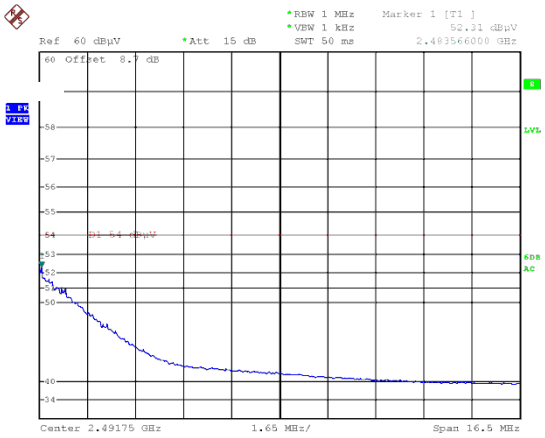
Date: 14.JAN.2016 04:16:27

Vertical
Peak



Date: 14.JAN.2016 04:25:53

Average



Date: 14.JAN.2016 04:24:49

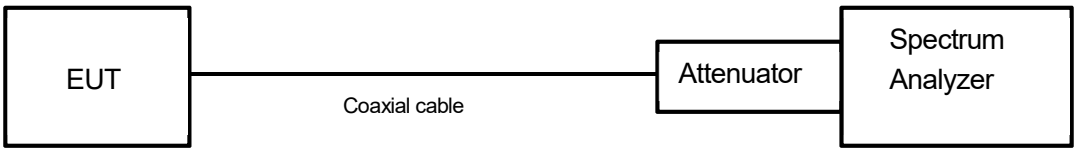
10. Transmitter Power Spectral Density

10.1 Measurement procedure
[FCC 15.247(e), RSS-247 5.2(2), KDB 558074 D01 v03r04, Section 10.2]

The peak power is measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate center frequency.

The spectrum analyzer is set to;
a) Span = 1.5 times the 6 dB bandwidth.
b) RBW = 3kHz - 100kHz.
c) VBW ≥ 3 x RBW.
d) Sweep time = auto-couple.
e) Detector = peak.
f) Trace mode = max hold.

- Test configuration



10.2 Limit

The peak power spectral density shall not be greater than 8dBm in any 3kHz band.

10.3 Measurement result

Date	:	January 8, 2016		
Temperature	:	21.4 [˚C]		
Humidity	:	49.2 [%]	Test engineer	:
Test place	:	Shielded room No.4		Hikaru Shibata

[IEEE802.11b]

Channel	Center Frequency (MHz)	Reading (dBm)	Factor (dB)	Level (dBm)	Limit (dBm)	Margin (dBm)	Result
Low	2412.00	-23.72	10.48	-13.25	8.00	21.25	PASS
Middle	2437.00	-22.09	10.48	-11.62	8.00	19.62	PASS
High	2462.00	-21.83	10.48	-11.36	8.00	19.36	PASS

Calculation;
Transmitter Power Spectral Density Level (Margin) = Limit – (Reading + Factor)

[IEEE802.11g]

Channel	Center Frequency (MHz)	Reading (dBm)	Factor (dB)	Level (dBm)	Limit (dBm)	Margin (dBm)	Result
Low	2412.00	-24.22	10.48	-13.75	8.00	21.75	PASS
Middle	2437.00	-22.45	10.48	-11.98	8.00	19.98	PASS
High	2462.00	-22.66	10.48	-12.19	8.00	20.19	PASS

Calculation;
Transmitter Power Spectral Density Level (Margin) = Limit – (Reading + Factor)

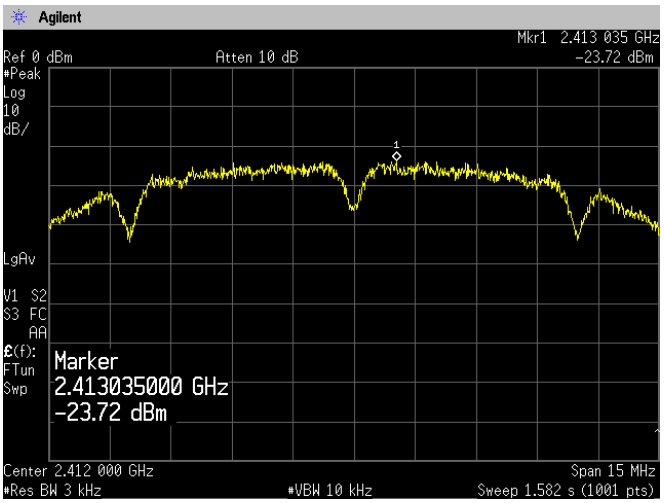
[IEEE802.11n (HT20)]

Channel	Center Frequency (MHz)	Reading (dBm)	Factor (dB)	Level (dBm)	Limit (dBm)	Margin (dBm)	Result
Low	2412.00	-24.52	10.48	-14.05	8.00	22.05	PASS
Middle	2437.00	-23.75	10.48	-13.28	8.00	21.28	PASS
High	2462.00	-22.77	10.48	-12.30	8.00	20.30	PASS

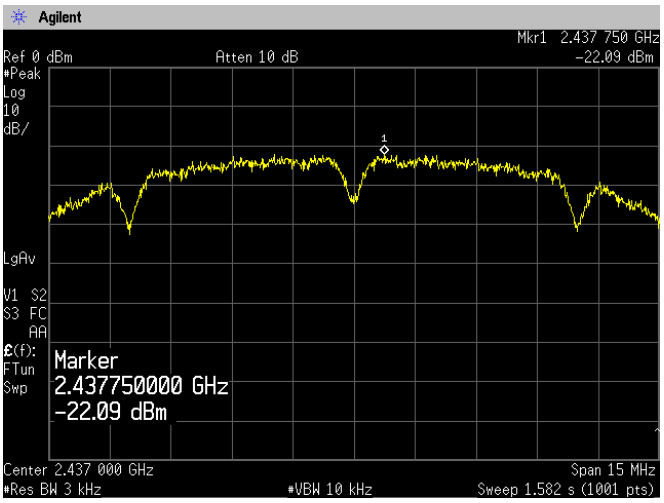
Calculation;
Transmitter Power Spectral Density Level (Margin) = Limit – (Reading + Factor)

10.4 Trace data [IEEE802.11b]

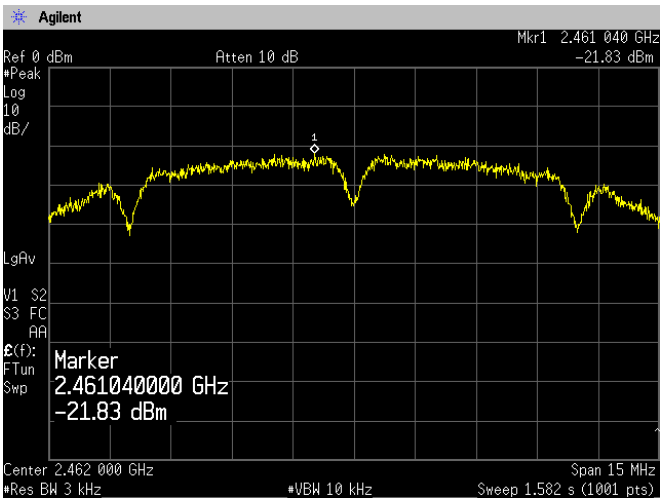
Channel Low



Channel Middle

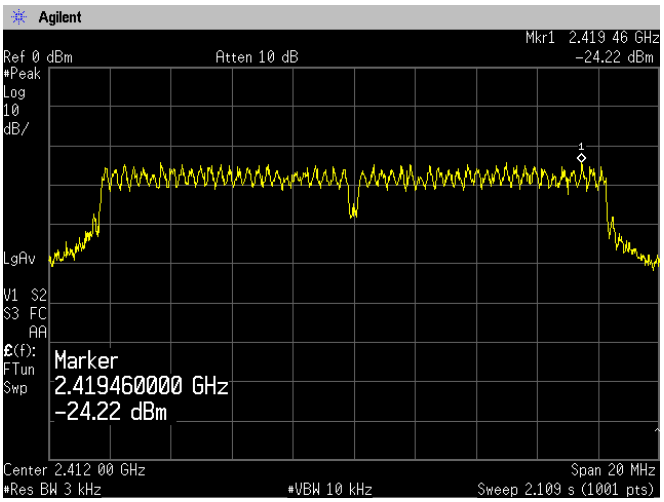


Channel High

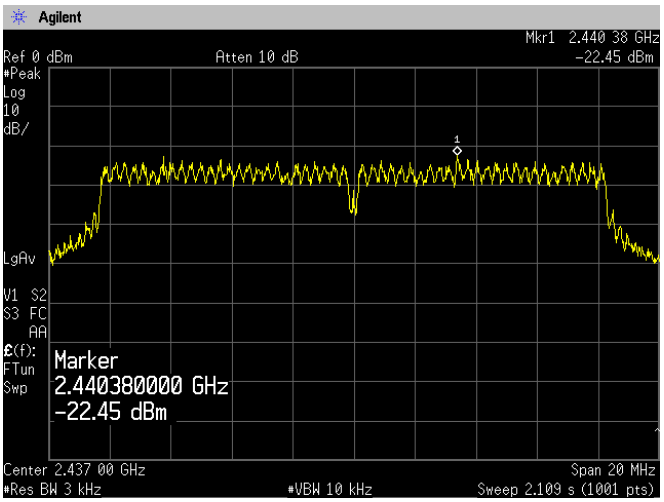


[IEEE802.11g]

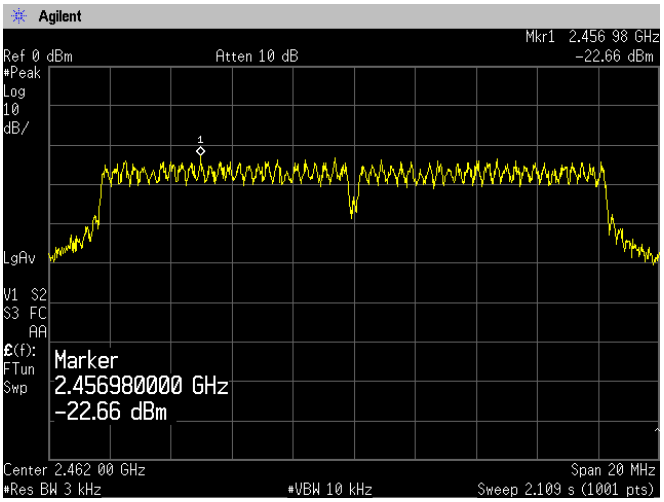
Channel Low



Channel Middle

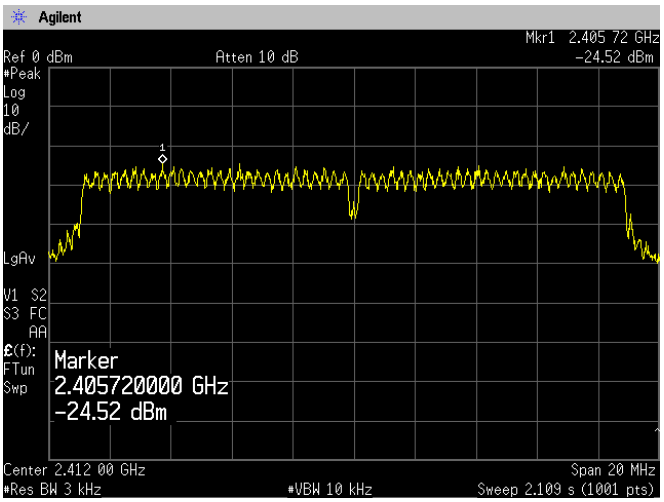


Channel High

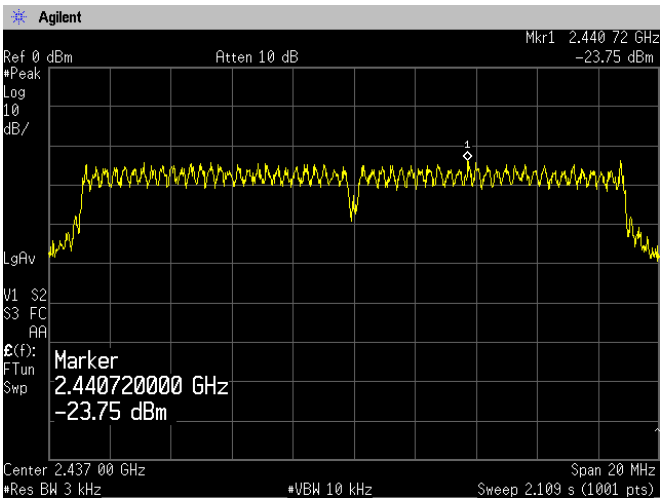


[IEEE802.11n (HT20)]

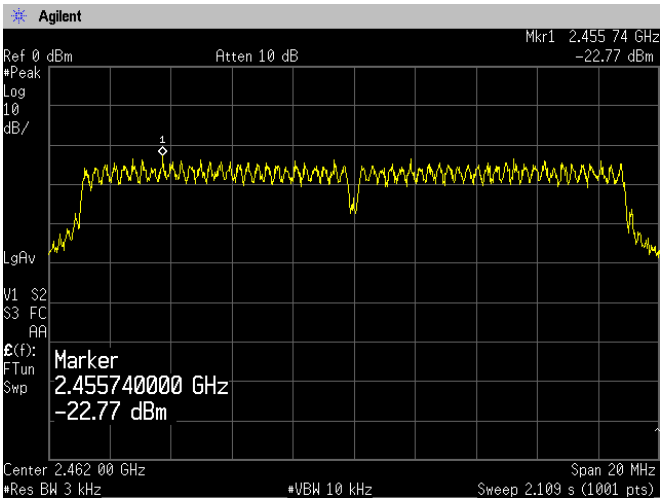
Channel Low



Channel Middle



Channel High



11. AC Power Line Conducted Emissions

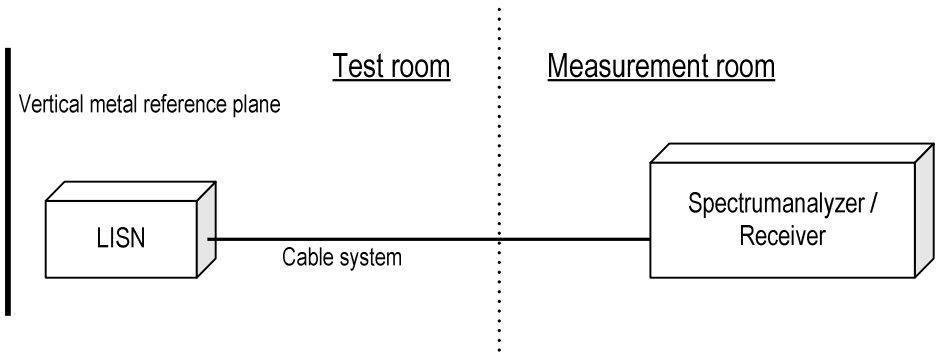
11.1 Measurement procedure [FCC 15.207, RSS-Gen 8.8]

Test was applied by following conditions.

Test method	:	ANSI C63.10
Frequency range	:	0.15MHz to 30MHz
Test place	:	10m Semi-anechoic chamber No.1
EUT was placed on	:	FRP table / (W)2.0m × (D)1.0m × (H)0.8m
Vertical Metal Reference Plane	:	(W)2.0m × (H)2.0m 0.4m away from EUT
Test receiver setting		
- Detector	:	Quasi-peak, Average
- Bandwidth	:	9kHz

EUT and peripherals are connected to 50Ω/50μH Line Impedance Stabilization Network (LISN) which are connected to reference ground plane, and are placed 80cm away from EUT. Excess of AC power cable is bundled in center.
LISN for peripheral is terminated in 50Ω.
EUT operating mode is selected to emit the maximum noise. Overall frequency range is investigated with spectrum analyzer using peak detector. Maximum emission configuration is determined by manipulating the EUT, peripherals, interconnecting cables. Then, emission measurements are performed with test receiver in above setting to each current-carrying conductor of the mains port. Sufficient time for EUT, peripherals and test equipment is provided in order for them to warm up to their normal operating condition. If the average limit is met when using a quasi-peak detector receiver, the EUT shall be deemed to meet both limits.

- Test configuration



11.2 Calculation method

Emission level = Reading + (LISN. factor + Cable system loss)
Margin = Limit – Emission level

11.3 Limit

Frequency [MHz]	Limit	
	QP [dBuV]	AV [dBuV]
0.15-0.5	66-56*	56-46*
0.5-5	56	46
5-30	60	50

*: The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.5MHz.

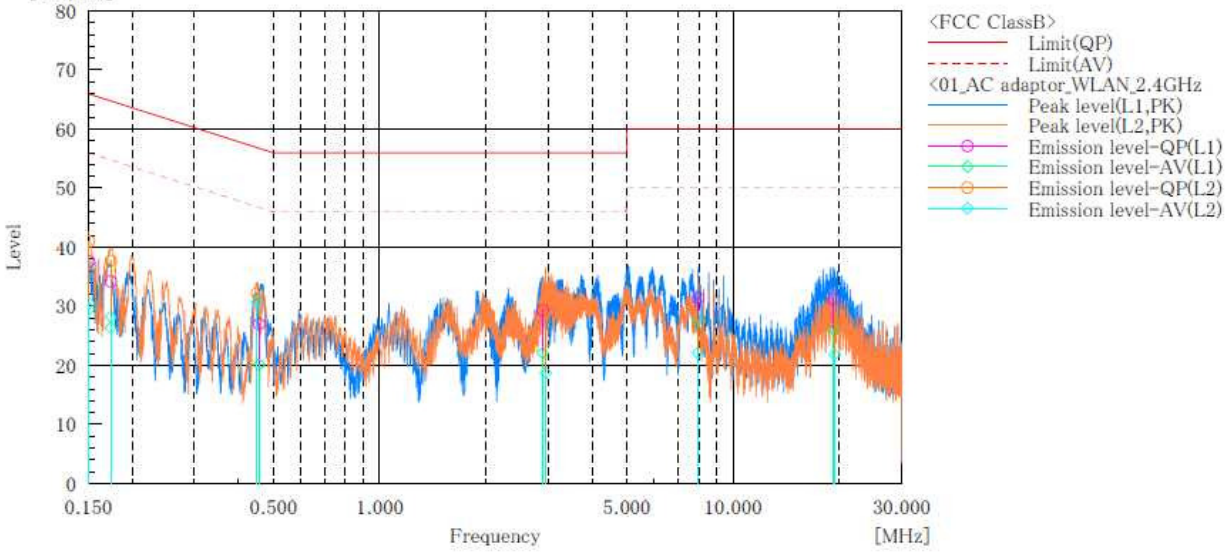
11.4 Test data

***** CONDUCTED EMISSION at MAINS PORT *****
[10m semi-anechoic chamber #1]

TUV SUD Zacta Ltd. <<DATA Sheet No.01>> 28 January,2016

Company name : SII
EUT : Wireless Module
Model No. : IFWL-001
Serial No. : 0011E5062AB1
Test mode : 2.4GHz_WLAN_11b_Tx

Standard : FCC Part15 subpart C
Operator : H.Shibata
Temp,Hum : 22.7[℃] 49.4[%]
Note1 : AC adaptor
Note2 :



Final Result

--- L1 Phase ---

No.	Frequency [MHz]	Reading QP [dB(μV)]	Reading AV [dB(μV)]	c.f [dB]	Result QP [dB(μV)]	Result AV [dB(μV)]	Limit QP [dB(μV)]	Limit AV [dB(μV)]	Margin QP [dB]	Margin AV [dB]
1	0.151	26.9	18.9	10.7	37.6	29.6	65.9	55.9	28.3	26.3
2	0.174	23.5	15.7	10.7	34.2	26.4	64.8	54.8	30.6	28.4
3	0.457	16.4	9.5	10.6	27.0	20.1	56.7	46.7	29.7	26.6
4	2.899	18.5	11.3	10.8	29.3	22.1	56.0	46.0	26.7	23.9
5	7.978	20.3	16.6	11.1	31.4	27.7	60.0	50.0	28.6	22.3
6	19.260	19.5	14.4	11.7	31.2	26.1	60.0	50.0	28.8	23.9

--- L2 Phase ---

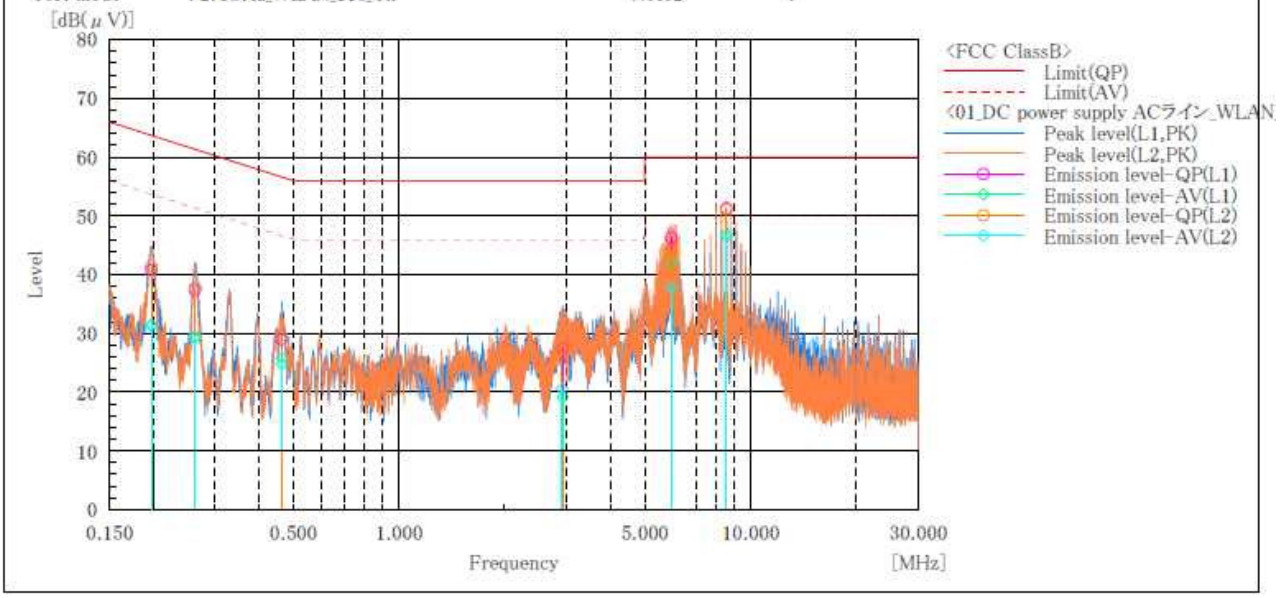
No.	Frequency [MHz]	Reading QP [dB(μV)]	Reading AV [dB(μV)]	c.f [dB]	Result QP [dB(μV)]	Result AV [dB(μV)]	Limit QP [dB(μV)]	Limit AV [dB(μV)]	Margin QP [dB]	Margin AV [dB]
1	0.151	30.2	19.7	10.8	41.0	30.5	65.9	55.9	24.9	25.4
2	0.174	26.9	17.4	10.8	37.7	28.2	64.8	54.8	27.1	26.6
3	0.451	21.5	20.1	10.7	32.2	30.8	56.9	46.9	24.7	16.1
4	2.953	18.8	7.8	10.9	29.7	18.7	56.0	46.0	26.3	27.3
5	7.957	15.3	10.9	11.2	26.5	22.1	60.0	50.0	33.5	27.9
6	19.380	15.4	10.0	11.8	27.2	21.8	60.0	50.0	32.8	28.2

Zacta

***** CONDUCTED EMISSION at MAINS PORT *****
[10m semi-anechoic chamber #1]

TUV SUD Zacta Ltd. <<DATA Sheet No.02>> 28 January,2016

Company name	: SII	Standard	: FCC Part15 subpart C
EUT	: Wireless Module	Operator	: H.Shibata
Model No.	: IFWL-001	Temp,Hum	: 22.7[℃] 49.4[%]
Serial No.	: 0011E5062AB1	Note1	: DC power supply AC line
Test mode	: 2.4GHz_WLAN_11b_Tx	Note2	:



Final Result

--- L1 Phase ---

No.	Frequency [MHz]	Reading QP [dB(μV)]	Reading AV [dB(μV)]	c.f [dB]	Result QP [dB(μV)]	Result AV [dB(μV)]	Limit QP [dB(μV)]	Limit AV [dB(μV)]	Margin QP [dB]	Margin AV [dB]
1	0.198	30.2	20.7	10.6	40.8	31.3	63.7	53.7	22.9	22.4
2	0.263	26.7	18.6	10.6	37.3	29.2	61.3	51.3	24.0	22.1
3	0.465	18.4	14.2	10.6	29.0	24.8	56.6	46.6	27.6	21.8
4	2.926	16.6	8.4	10.8	27.4	19.2	56.0	46.0	28.6	26.8
5	5.955	35.3	31.0	11.0	46.3	42.0	60.0	50.0	13.7	8.0
6	8.547	40.1	35.7	11.2	51.3	46.9	60.0	50.0	8.7	3.1

--- L2 Phase ---

No.	Frequency [MHz]	Reading QP [dB(μV)]	Reading AV [dB(μV)]	c.f [dB]	Result QP [dB(μV)]	Result AV [dB(μV)]	Limit QP [dB(μV)]	Limit AV [dB(μV)]	Margin QP [dB]	Margin AV [dB]
1	0.198	30.7	20.8	10.7	41.4	31.5	63.7	53.7	22.3	22.2
2	0.264	27.1	18.8	10.7	37.8	29.5	61.3	51.3	23.5	21.8
3	0.464	18.9	15.1	10.7	29.6	25.8	56.6	46.6	27.0	20.8
4	2.912	16.5	9.7	10.9	27.4	20.6	56.0	46.0	28.6	25.4
5	5.943	33.0	26.8	11.1	44.1	37.9	60.0	50.0	15.9	12.1
6	8.545	39.8	35.2	11.3	51.1	46.5	60.0	50.0	8.9	3.5

Zacta

12. Antenna requirement

According to FCC section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.
The antenna is a special antenna mounted inside of the EUT. Therefore, the EUT complies with the antenna requirement of FCC section 15.203.

Zacta

13. Uncertainty of measurement

Expanded uncertainties stated are calculated with a coverage Factor k=2.
Please note that these results are not taken into account when measurement uncertainty considerations contained in ETSI TR 100 028-0011 determining compliance or non-compliance with test result.

Test item	Measurement uncertainty
Conducted emission at mains port	±3.0dB
Radiated emission (9kHz – 30MHz)	±4.4dB
Radiated emission (30MHz – 1000MHz)	±4.5dB
Radiated emission (1000MHz – 26GHz)	±3.9dB

14. Laboratory description

1. Location:

TÜV SÜD Zacta Ltd. Yonezawa Testing Center
4149-7 Hachimanpara 5-chome Yonezawa-shi Yamagata 992-1128 Japan
Phone: +81-238-28-2880 Fax: +81-238-28-2888

2. Facility filing information:

1) NVLAP accreditation: NVLAP Lab. code: 200306-0

2) VLAC accreditation: Lab. code: VLAC-013

Site name	Radiated emission	Conducted emission for mains port	Conducted emission for telecom port	Radiated emission (CMAD)	Expiry Date
3m Semi-anechoic chamber	VLAC-013			-	Jul. 3, 2017
10m Semi-anechoic chamber No.1				VLAC-013	
10m Semi-anechoic chamber No.2					
Shielded room No.1	-	VLAC-013		-	

3) FCC filing:

Site name	Registration Number	Expiry Date
Site 3	91065	Oct. 1, 2017
3m Semi-anechoic chamber	540072	Feb. 20, 2017
10m Semi-anechoic chamber No.1		
10m Semi-anechoic chamber No.2		
Shielded room No.1		

4) Industry Canada Oats site filing:

Site name	Sites on file: Oats 3m/10m	Expiry Date
Site 3	4224A-3	Dec. 3, 2017
3m Semi-anechoic chamber	4224A-4	
10m Semi-anechoic chamber No.1	4224A-5	
10m Semi-anechoic chamber No.2	4224A-6	Jan. 15, 2017

5) VCCI site filing:

Site name	Radiated emission	Conducted emission for mains port	Conducted emission for telecom port	Expiry Date
Site 3	R-138	C-134	T-1222	Nov. 16, 2017
3m Semi-anechoic chamber	A-0166			Jul. 3, 2017
10m Semi-anechoic chamber No.1				
10m Semi-anechoic chamber No.2				
Shielded room No.1	-	A-0166		

6) TÜV SÜD PS authorization:
Authorized as an EMC test laboratory

7) TÜV Rheinland authorization:
Authorized as an EMC test laboratory

Appendix A. Test equipment

Antenna port conducted test

Equipment	Company	Model No.	Serial No.	Cal. due	Cal. date
Spectrum analyzer	Agilent Technologies	E4440A	US44302655	Jun. 30, 2016	Jun. 11, 2015
Microwave cable	RS	YH-13S5	N/A (S403)	May 31, 2016	May 10, 2015
Coaxial cable	RS	YH20_S1	N/A (S389)	Aug. 31, 2016	Aug. 6, 2015
Attenuator	Weinschel	56-10	J4993	Nov. 30, 2016	Nov. 12, 2015
Power meter	ROHDE&SCHWARZ	NRP2	103269	Jun. 30, 2016	Jun. 25, 2015
Power sensor	ROHDE&SCHWARZ	NRP-Z81	102467	Jun. 30, 2016	Jun. 25, 2015

Radiated emission

Equipment	Company	Model No.	Serial No.	Cal. Due	Cal. Date
EMI Receiver	ROHDE&SCHWARZ	ESCI	100765	Sep. 30, 2016	Sep. 2, 2015
Preamplifier	ANRITSU	MH648A	M08067	Jun. 30, 2016	Jun. 30, 2015
Loop antenna	ROHDE&SCHWARZ	HFH2-Z2	892246/010	Apr. 30, 2016	Apr. 2, 2015
Attenuator	TDC	TAT-43B-06	N/A (S209)	Apr. 30, 2016	Apr. 16, 2015
Biconical antenna	Schwarzbeck	VHA9103/BBA9106	2850	Jun. 30, 2016	Jun. 17, 2015
Log periodic antenna	Schwarzbeck	UHALP9108A	0991	Jun. 30, 2016	Jun. 17, 2015
Attenuator	TME	CFA-01NPJ-6	N/A (S273)	Jun. 30, 2016	Jun. 23, 2015
Attenuator	TME	CFA-01NPJ-3	N/A (S270)	Jun. 30, 2016	Jun. 23, 2015
Spectrum analyzer	Agilent Technologies	E4447A	MY46180188	Mar. 31, 2016	Mar. 31, 2015
Preamplifier	Agilent Technologies	8449B	3008A1008	Oct. 31, 2016	Oct. 29, 2015
Double ridged guide antenna	ETS LINDGREN	3117	00052315	Feb. 29, 2016	Feb. 20, 2015
Preamplifier	TSJ	MLA-100M18-B02-40	1929118	May 31, 2016	May 1, 2015
Attenuator	HUBER+SUHNER	6803.17.B	N/A(2340)	Feb. 31, 2016	Mar. 9, 2015
Attenuator	AEROFLEX	26A-10	081217-08	May 31, 2016	May 5, 2015
Broad-Band Horn Antenna	Schwarzbeck	BBHA9170	BBHA9170189	Jun. 30, 2016	Jun. 16, 2015
Preamplifier	TSJ	MLA-1840-B03-35	1240332	Jun. 31, 2016	Jun. 6, 2015
Notch filter	Micro-Tronics	BRM50702	045	Nov. 30, 2016	Nov. 12, 2015
Microwave cable	SUHNER	SUCOFLEX104/9m	346315/4	May 31, 2016	May 29, 2015
		SUCOFLEX104/1m	MY24628/4	May 31, 2016	May 29, 2015
		SUCOFLEX104/2m	317672/4	May 31, 2016	May 29, 2015
		SUCOFLEX104/13m	41623/6	May 31, 2016	May 29, 2015
Microwave cable	HUBER+SUHNER	SUCOFLEX104/9m	MY23758/4	May 31, 2016	May 29, 2015
PC	HP	dc7800small	JPA7450FPJ	Apr. 30, 2016	Apr. 30, 2015
Software	TOYO Corporation	EP5/RE-AJ	0611193/V5.4.011	N/A	N/A
10m Semi-anechoic chamber	TOKIN	N/A	N/A (9001-NSA 3m)	Apr. 30, 2016	Apr. 30, 2015
10m Semi-anechoic chamber	TOKIN	N/A	N/A (9001-SVSWR)	Apr. 30, 2016	Apr. 28, 2015
Absorber	RIKEN	PFP30	N/A	N/A	N/A
Absorber	TOKIN	TUA	N/A	N/A	N/A

Conducted emission at mains port

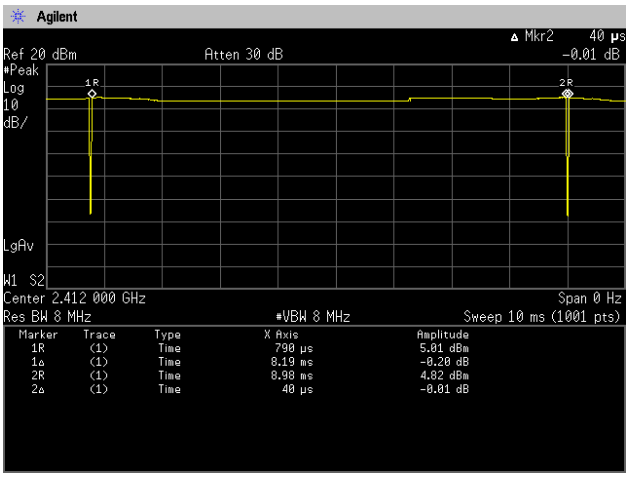
Equipment	Company	Model No.	Serial No.	Cal. due	Cal. date
EMI Receiver	ROHDE&SCHWARZ	ESCI	100765	Sep. 30, 2016	Sep. 2, 2015
Attenuator	TYC	BA-PJ-10	N/A (S344)	Apr. 30, 2016	Apr. 6, 2015
Line impedance stabilization network for EUT	Kyoritsu Electrical Works, Ltd.	KNW-407F	8-2003-1	Mar. 31, 2016	Mar. 5, 2015
Line impedance stabilization network	Kyoritsu Electrical Works, Ltd.	KNW-242F	8-1094-5	Jun. 30, 2016	Jun, 24, 2015
5Coaxial cable	FUJIKURA	5D-2W/4m	N/A (S349)	Feb. 29, 2016	Feb. 27, 2015
Coaxial cable	SUHNER	SUCOFLEX104/2m	317672/4	May. 31, 2016	May. 29, 2015
Coaxial cable	SUHNER	RG214/U/25m	N/A (S191)	Feb. 29, 2016	Feb. 27, 2015
PC	HP	Dc7800small	JPA7450FPJ	N/A	N/A
Software	TOYO Corporation	EP5/CE-AJ	0611193/V5.6.000	N/A	N/A

*: The calibrations of the above equipment are traceable to NIST or equivalent standards of the reference organizations.

Appendix B. Duty Cycle

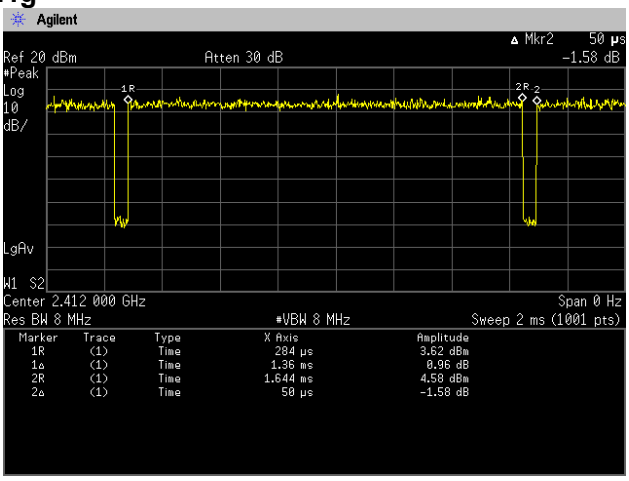
[Plot & Calculation]

11b



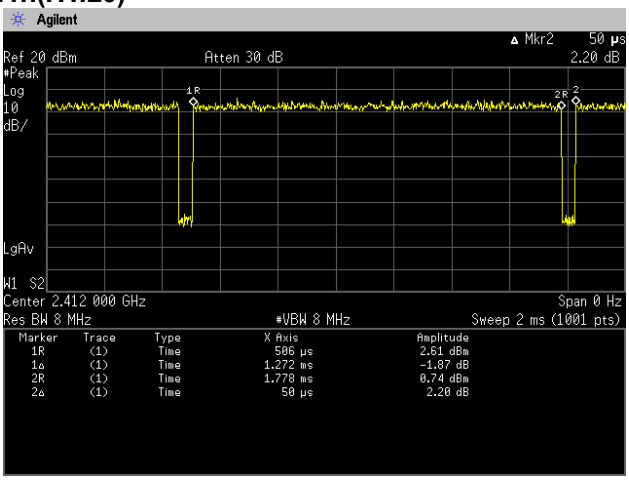
Duty Cycle = T_{on} / (T_{on} + T_{off}) = 8190[us] / (8190[us] + 40[us]) = 99.51[%]

11g



Duty Cycle = T_{on} / (T_{on} + T_{off}) = 1360[us] / (1360[us] + 50[us]) = 96.45[%]

11n(HT:20)



Duty Cycle = T_{on} / (T_{on} + T_{off}) = 1272[us] / (1272[us] + 50[us]) = 96.22[%]